

Organ Pipe Cactus

NATIONAL MONUMENT



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NATIONAL PARK SERVICE

George B. Hartzog, Jr., Director

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BOOK NUMBER SIX*

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Organ Pipe Cactus

NATIONAL MONUMENT/Arizona

Natt N. Dodge

NATURAL HISTORY HANDBOOK SERIES/No. 6

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ADMINISTRATION

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The National Park System, of which this area is a unit, is dedicated to conserving the scenic, scientific, and historic heritage of the United States for the benefit and enjoyment of its people.

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NEAR ARIZONA'S RENDEZVOUS WITH CALIFORNIA AND MEXICO, *there is a world of space and color. Its horizons appear held apart by sky, its mountains look flatly two-dimensional, and its spectacular vegetation seems borrowed from another planet.*

Reaching northward from the wilderness of northwestern Sonora, a sub-tropical finger of the Mexican gulf coast desert extends from the Gulf of California into a broad, mountain-fringed valley of southwestern Arizona. Accompanying a relatively frost-free climate, this vegetative probe meets the eastern edge of the California microphyll desert and the western rim of the Arizona succulent desert.

Here, within the 516 square miles of Organ Pipe Cactus National Monument, plants and animals of these three phases of the great Sonoran Desert merge to form rich and varied biological communities. This scenic wilderness of rugged mountains, cactus-studded slopes, and desert flats is an American heritage preserved for the enjoyment of the people. Bathed in bright sunlight and clean, clear air, this amazing world awaits your discovery.





Desert Landscapes



IF YOU PASS THROUGH the north entrance of Organ Pipe Cactus National Monument on an early spring morning following a relatively wet winter, you will be greeted by an amazing display of luxuriant vegetation and colorful wildflowers. Road shoulders gleam with desertgold and desert bailey. A blanket of purple escobita, mingling with blue lupines and yellow Mexican goldpoppies, carpets the desert floor. Hillsides glow with clumps of daisylike brittlebush, and desert washes are fringed with paloverde trees, their new leaves hidden beneath a mass of yellow flowers.

“Can this paradise be a *desert*?” you exclaim.

The biologist regards as deserts those regions in which “deficient rainfall and all its consequences have made a strong impression on the structure, functions, and behavior of living things.” The climate of the desert often presents the upper



limits of temperature and the lower limits of moisture in which plants can grow and animals survive.

Many centuries ago primitive Indians learned to live in precise adjustment to the severe, unchanging requirements of this hot, dry environment; they, too, are a part of its native life.

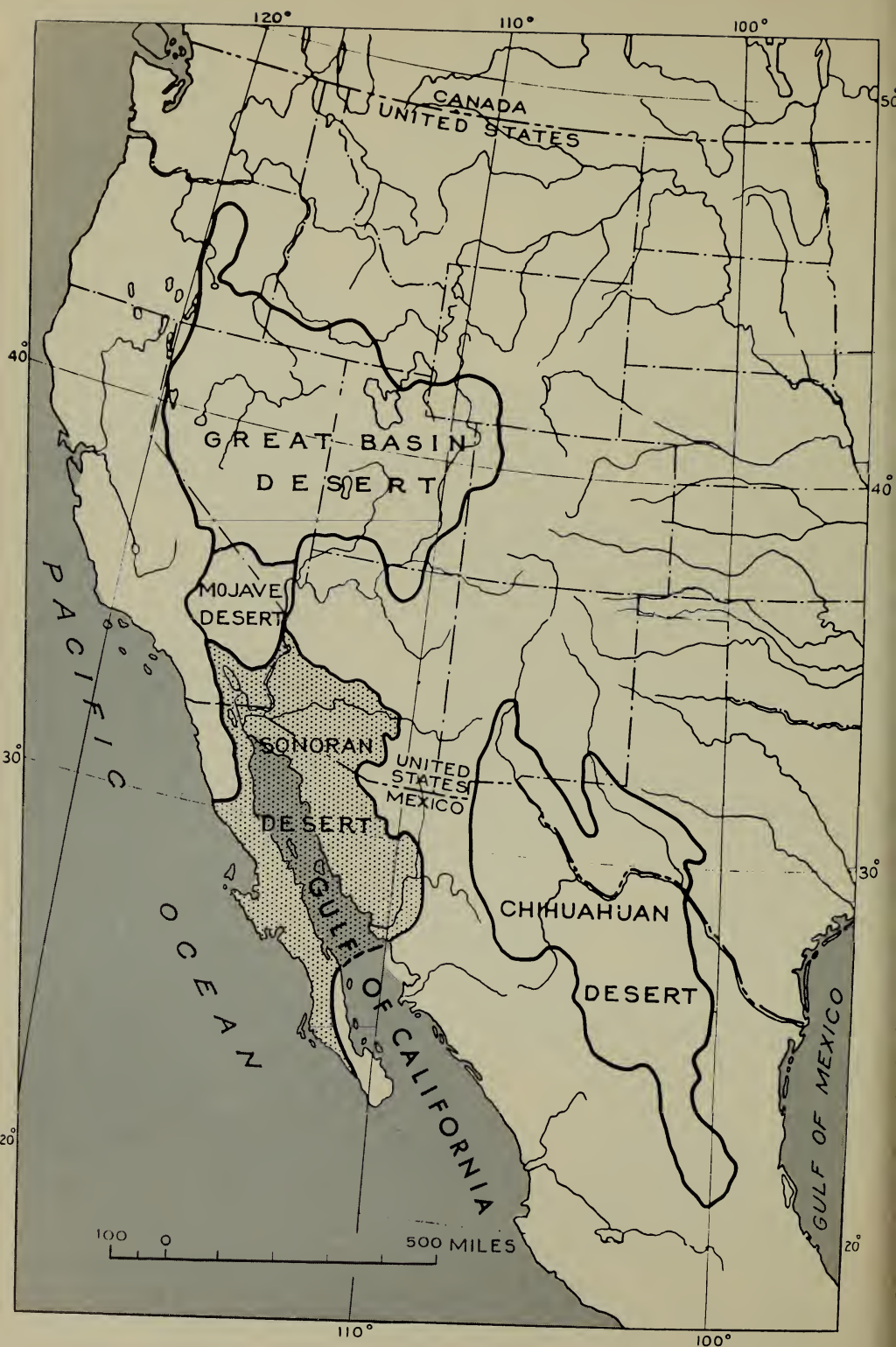
It has been only since the 1930's that mankind brought to the desert the conveniences and comforts of modern civilization. Surrounded and fortified with these, you will find that the desert is a strange, beautiful, and thoroughly delightful place in which to visit and to live. You will find that it presents for your pleasure and exploration a great many appealing, significant, and almost unbelievable facets of nature.

Mountains rising from the desert provide environments for many different plant and animal communities and ecological niches in addition to those found in the surrounding lowlands.



Desert Vegetation,
THE PRINCIPAL ATTRACTION

Coville creosotebush in flower and fruit.



WHEN YOU FIRST VISIT this National Monument, you will be profoundly impressed with the unusual forms of plantlife. Here, through many centuries of adaptation, plants have developed physical and functional means which enable them to thrive under the rigid requirements of restricted and uncertain rainfall, high temperatures, drying winds, and various types of soil.

As you become accustomed to the desert, you will begin to notice striking differences in the type and density of vegetation in various parts of the monument. Responsible for this are the physical and chemical properties of the soils, amount and distribution of moisture, degree and direction of slope, exposure and elevation, and also the influence of other plants and animals.

The striking variety of luxuriant plant growth that gives significance to Organ Pipe Cactus National Monument stems from its geographic location at the head of the Sonoyta Valley—a broad lowland stretching northeastward from the Gulf of California. Centuries ago, the tiny Sonoyta River flowed almost due west, but extensive volcanic activity in the region of the present Pinacate Craters blocked the river's course and turned it southward, where its scant waters now become lost in the desert sands.

Thus, only here, where the Sonoyta Valley brings northward a fingerlike extension of a southern climate, do a few species of plants typical of the central gulf coast phase of the Sonoran Desert cross the international boundary. Only here will you find in any abundance within the United States such plants as sapium, a relative of the Mexican jumping-bean, the pudgy elephanttree, Mexican nettlespurge, the rare senita, and huge clumps of the spectacular organpipe cactus, from which the monument derived its name.

But this extension of Mexican plants is only part of the story. The monument also contains a highly scenic section of that widespread region in which plants of the drought-ridden California microphyll desert blend with those of the more liberally watered Arizona succulent (upland) desert. In this unique meeting place of three desert vegetative types, and in a magnificent setting of basin-and-range topography, the manifestations of the great Sonoran Desert reach an unexcelled peak.

The desert areas of North America. Organ Pipe Cactus National Monument is located at approximately the second "o" in "Sonoran." From *"Plant Life of The Sonoran Desert,"* by Forrest Shreve.

California Microphyll Desert

The term "microphyll" means small leaved. Reduction of the surface areas of their leaves, through which transpiration (loss of water) occurs, is one of the principal adaptations of plants to dry environments. In general, plants of the wide flatlands of the lower Colorado River valley of southeastern California and southwestern Arizona have this characteristic. In the monument, California microphyll desert dominates the area west of the Growler Mountains and Quitobaquito Hills.

The late Dr. Forrest Shreve for many years carried on investigations for the Carnegie Institution of Washington regarding the vegetation of the Sonoran Desert. His studies show that over much of the microphyll desert, creosotebush and bur-sage provide up to 80 percent of the plant population. Usually the two are found together. This somewhat monotonous scene is occasionally broken by small groves of the tall, stiff-branched ocotillo and the leafless holacantha, or crucifixion-thorn. (For pronunciation of unfamiliar words, see glossary.) Within sandy washes the graceful, plumelike crowns of the smokethorn demand attention. Along the borders of these washes is a shrub or small tree called mesquit acacia, with the slender, sprawling stems of the holycross, or rattail, cholla growing beneath its shelter. Along the bases of the Agua Dulce Hills, the landscape is dotted with clumps of a red-sapped shrub called nettlespurge, or sangre-de-drago (blood-of-the-dragon). Pencil cholla, a compact dwarf tree cactus, often with a distinct trunk, is found singly, or occasionally as small thickets, along the western bases of the Growler Mountains and Puerto Blanco Mountains.

Although the vegetative cover of the microphyll desert is, in general, unspectacular, a number of the plant species are of particular interest and noticeable when in bloom.

Of these, the ocotillo, among the best known and most widespread of Sonoran Desert shrubs, is common throughout the monument. Its long, whiplike stems grow as an inverted cone rising 4 to 15 feet above the ground. After a rain, these stems become covered with a dense growth of small, green leaves and from March to May produce at their tips large, showy clusters of bright-red flowers. As soon as the soil dries, the plants drop their leaves and remain semidormant as bare, thorn-armed stems until the next shower stimulates refoliation. This cycle may be repeated several times during a season. Thus, owing to spotty showers, the plants may be in full leaf in one part of

the monument while those only a short distance away may be bare of foliage.

Ocotillos usually occur sparsely in the microphyll desert, but they are abundant on the upper piedmont plains (the sloping, gravelly bajadas, or alluvial fans, spreading out from the mouths of canyons) and on rocky hillsides where succulents abound. In such locations, ocotillos often mingle with tree chollas and stands of organpipe cactus.

The holacantha, or crucifixion-thorn, grows singly or in small thickets. It is restricted to the flatlands in the tight soil of the outwash plains far from the mountains, where it sometimes rises above the other vegetation. Flowers are greenish yellow and inconspicuous, but the harsh masses of brown fruit-clusters add to the plant's strange appearance. Lack of leaves, whose food-making function has been taken over by chlorophyll-containing bark, has lowered the holacantha's water requirements.

Common throughout desert regions of the Southwest, Coville creosotebush is the dominant shrub of the microphyll flatlands. Local people call it greasewood because of the waxy, moisture-retaining covering of the leaves. It gives off a musty odor when wet. The pale-yellow flowers, abundant in spring, are superseded by round, fuzzy white fruits which give the bushes a frosted appearance. Ideally fitted for life in a hot, dry environment, creosotebushes grow at evenly spaced intervals. Their widespread roots are so grasping of moisture that only the shallow-rooted, short-lived annuals can compete with them. Recent investigations indicate that creosotebushes may deposit a toxic substance in the ground that discourages the growth of other plants. However, following soaking winter rains, the topsoil between plants may be covered for a few weeks with a dense growth of desert Indian-wheat, while after summer showers these spaces may be taken over briefly by the annual, shallow-rooted grama grasses. Shreve's studies indicate that an individual creosotebush might live for more than 100 years.

Much of the ground surface between clumps of creosotebush is covered with a mosaic of pebbles, called desert pavement. It is largely a result of wind and sheet-water erosion, which have removed the light surface soil, leaving a tightly packed accumulation of small stones. This desert pavement resists the further action of the agencies that produced it.

Along with creosotebush, bur-sage is among the most common and widespread plants in both the microphyll and succu-



lent deserts, but it is relatively inconspicuous. Similar to common ragweed, to which it is closely related, bur-sage also resembles the common cocklebur. White bur-sage is the close companion of creosotebush in the microphyll desert, giving place to triangle bur-sage among the succulents farther east. Both species occur in Organ Pipe Cactus National Monument. Bur-sage, which flowers in March and April, is one of the annoying hay-fever plants of the desert.

Although often mixed with other vegetation, the gray-green cattle saltbush is sometimes found in nearly pure stands where flooding has resulted in moderate amounts of alkali. This shrub grows 3 to 5 feet high. Its flowers, which appear in summer and early autumn, are inconspicuous, but the plants themselves attract attention and are often mistakenly called sagebrush. Its leaves provide excellent browse for deer and pronghorns. In former times, Papago Indians parched the seeds and ground them into meal.

Grasses are notably absent over much of the desert floor. In some sandy locations, however, clumps of big galleta remind us that certain grasses have become adapted to desert conditions. After summer rains, fast-growing but short-lived annual grasses cover many desert flatlands with a blanket of green.

Found along the washes which cross desert flats and also on gravelly slopes of the upper alluvial fans is California beloperone, or desert-honeysuckle. This is a low-growing, distinctly leafy shrub with brilliant red flowers that attract hummingbirds. Common throughout southeastern California, this species ranges into the monument but it is rarely found east of the Ajo Mountains.

Where gravelly washes wind across creosotebush-covered flats, their otherwise brush-hidden courses are often revealed from a distance by narrow belts of blue paloverde mixed with mesquites and an occasional tesota, or desert-ironwood tree.

Tesotas, which grow to be 30 feet tall with a trunk diameter of 18 inches, are easily identified by their evergreen leaves. Foliage is browsed by bighorn (mountain sheep), while the nutritious seeds are harvested by rodents and were formerly

Whiplike stems of ocotillo (upper left) rise beside organpipe cactus. Buds and blossoms of ocotillo (below) are bright red. Strange-looking, leafless crucifixion-thorn (upper right) grows only in the tight soil of desert flats.



parched and eaten by Indians. The wisteria-like lavender-and-white flowers are abundant in May and June. The wood is so hard and dense that it sinks in water. Indians used it for arrowheads and tool handles.

Within recent years, many tesotas in the western part of the monument have become heavily infested with parasitic mesquite American-mistletoe, which has killed branches and some entire trees. Fruits of the mistletoe are eaten by several species of birds, one of which, the phainopepla, relies on them as a major item of its winter diet. Use by birds helps to spread the parasite to other trees. Paloverde and mesquite also are subject to mistletoe infestation.

Velvet mesquites are widely distributed throughout the desert part of the monument, particularly bordering washes. In April and May the pale-yellow, drooping flower-clusters attract swarms of insects. In former times, mesquite beans were a mainstay of life for the Pima and Papago Indians. The long, sweet pods were ground into meal which served as a staple food. Branches and trunks of mesquite trees were the principal source of firewood for the Indians.

Mesquites usually do not drop their leaves as a means of lowering water losses. Instead, by noon they fold their leaves along the mid-rib, thereby reducing the area of leaf surface affected by dry air currents. The extremely long taproot, reported to reach a depth of 40 to 60 feet, takes advantage of ground moisture inaccessible to other plants. Thus, the mesquite resists desert dryness, with almost as much of the tree below ground as above.

Two noticeable plants grow sparingly along the bottoms of sandy washes. One is the smokethorn (smoketree), an important member of the vegetation of the California microphyll desert that reaches the extreme eastern limit of its range within the western part of the monument. Leafless, the slender ashy-gray branches form a dense, somewhat plumelike crown that, at a distance, looks like smoke from a campfire. In May and June the tree is covered with small, violet-to-indigo flowers. Individuals in the monument are dwarfed and shrubby,

(Above) Following summer rains, the desert floor is carpeted with green, short-lived annual grasses. (Below) Tesota, or ironwood, is an indicator of a generally frost-free climate.

although trees of this species in desert washes near the Colorado River reach a height of 20 feet.

The other rare invader, this one coming from the Mexican desert to the south, is the senita, or sinita, cactus. Superficially it resembles the organpipe cactus. Senita clumps are easily identified by the deeply ridged 5- or 6-ribbed stems, rarely exceeding 10 feet in height. Clusters of long gray spines cover the tips of the older stems, giving the plant the local name "whisker cactus." Found only along the extreme southern edge of the monument, which is its northern range limit, the senita spreads by the rooting of parts of stems buried in sand. Senita clumps, with 50 or more stems, sometimes spread over many square yards along the bottoms and edges of sandy washes and gravelly flats. The senita is one of the spectacular plants of the gulf coast part of the Sonoran Desert. Its small, pale-pink flowers open at night in May and June.

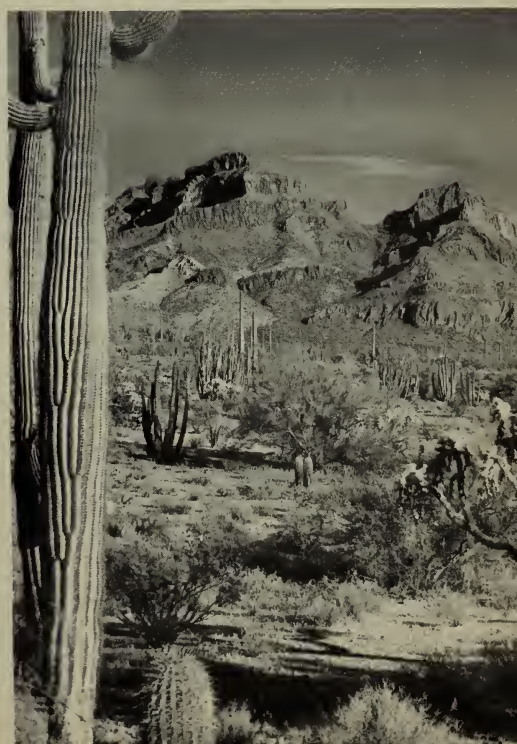
A number of other plants help to form the vegetation characteristic of drainageways that cross the flats and lower bajadas. Among them are broom baccharis (desert broom, or rosinbrush), white burrobrush, and desert tobacco.

Succulents

On the upper bajadas and along the foothill slopes of the Ajos, the Growlers, the Puerto Blancos, and among the ridges of the Sonoyta Hills, succulent plants grow in greatest density. As you leave the open valley floor and begin to ascend a bajada toward the base of the mountains, you will observe a gradual change in the ground cover. Vegetation becomes tangled, plants are larger and thriftier, the number of trees and large cactuses increases, and new species appear. Shreve wrote that "the distance from the base of the mountain at which these changes begin and the extent of the change are dependent on the rainfall and the character of the detrital material. . . . In

Common in northern Mexico, the senita cactus (above) reaches its northern limit along the southern edge of the monument. Smokethorn (lower left), found sparingly in the southwest corner of the monument, is more plentiful farther west.

Succulents grow most luxuriantly on sloping bajadas and foothills, such as those of the Ajo Mountains (lower right).



general the amount of change is directly proportional to the size of the mountain from which the bajada descends."

The large number and variety of succulent plants (those which have developed special water-storing tissues) have given to the extensive landscape covered with this type of vegetation the name "Arizona succulent desert." Storing water for frugal use during long periods of drought is one of the methods that plants have evolved for maintaining life under rigorous desert conditions. Some plants, such as the yuccas and agaves, have developed water-storage tissues in their leaves, and they are known as leaf-succulents. Many other plants, called stem succulents, store water in their stems. Still others produce greatly enlarged roots which serve as underground reservoirs effectively protected from the drying effects of wind and sun.

One of the latter group, found sparingly in the monument, is the deerhorncactus, locally called "nightblooming-cereus." The turnip-shaped root of this species ordinarily weighs from 5 to 15 pounds, but specimens weighing up to 80 pounds have been found. The slender-stemmed plants are quite inconspicuous except in late June or early July, when they produce, during the night, large white flowers, exquisite and fragrant, that are locally known as *reina-de-la-noche* (queen-of-the-night). A closely related species, with huge clusters of dahlia-like roots, also occurs in the monument.

Succulents that have developed water-storage tissues in their stems are the most abundant. They are represented by the many and varied leafless cactuses. Some cactuses have jointed stems, others are blocky and barrel shaped, while still others have long, cylindrical stems without joints.

In this last group is the famous organpipe cactus, which finds an ideal habitat on the sloping bajadas. These curious plants dominate the landscape on the lower slopes of the mountains and along the rocky ridges that interrupt the outwash plains.

Some of the huge plants grow as tight clumps, with many green stems that range from 5 to 20 feet in height. These generally unbranched stems usually spring from a common root system at ground level. Other individuals are languidly sprawling, with fewer, less upright arms. Stems have from 12 to 19

Opening at night, blossoms of the deerhorncactus (above) and saguaro cactus (below) lend their brief beauty to the desert scene.





ribs, each producing a surface ridge with a long row of star-shaped clusters of stout spines. Blossoms, which are brownish green to pinkish lavender and are about 1½ inches in diameter, usually open during May nights, on or near the tips of the branches. In midsummer, spherical fruits mature. Their reddish pulp is juicy, sweet, and nutritious, and it is harvested by birds and small mammals.

These fruits are also eaten by the Papago Indians, who call them "pitahaya dulce." Some of the fruits are eaten fresh and others are cooked, the pulp and seeds being separated from the juice for storage. The juice is boiled down to form a thick syrup; the pulp is dried and later used in jam; and the seeds are ground to form a mealy paste. Members of the present generation of Papago Indians on the reservation east of the Ajo Mountains have fitted themselves more and more into the modern pattern of life, depending less, as time passes, on native food sources. But caves with smoke-blackened walls and other indications of former Indian camps give evidence that the region along the southwestern base of the Ajos was at one time the scene of colorful Papago pitahaya harvest activities.

Organpipe cactus plants are sensitive to frost. Although a light freeze does not kill the plant, damage is done to the growing stem tips which stops further elongation. Frosted stems sometimes branch below the damaged tip, and the plant sends up new shoots from ground level. Susceptibility to frost injury apparently is an important factor in limiting the range of the species to a climatic zone which is relatively frost free. This may explain the scarcity of organpipes much beyond the head of the Sonoyta Valley. The abundance of this spectacular species, together with the wealth of other Sonoran Desert plants and animals, was one of the reasons this biologically rich area was selected for preservation as a National Monument.

Although near the western limit of its range, the giant saguaro cactus is abundant on the bajadas, where rocky, well-drained soil provides suitable conditions for the development of several especially dense stands, or "forests." Largest of the succulents in the United States, the saguaro occasionally reaches a

Organpipe cactus is a striking sight on the monument's foothill slopes and sometimes grows to great size (upper right). In May it produces small blossoms (below). The sweet, juicy fruits (upper left) are eaten by Papago Indians, who call them pitahaya dulce.

height in excess of 50 feet and a weight estimated to be as much as 10 tons. These plants have a distinct trunk, with from as few as 1 to as many as 50 branches, usually upright. Some plants may attain an age of 200 years.

The large, white-petaled flowers of the saguaros open at night, usually in May, among dense clusters of buds on and near the ends of the branches. Blossoms usually close before mid-afternoon of the following day. The egg-shaped fruits mature in late June and early July, splitting open when ripe to reveal a scarlet interior containing a mass of juicy pulp filled with a myriad of black seeds. The enormous seed crop stands in sharp contrast to the very small number of young plants that survive in even the most favorable years. Growth of seedlings is extremely slow, so that a 10-year-old plant may be little more than 1 inch high. Later growth is variable, and a 3-foot plant may be from 20 to 50 years old.

The saguaro occupies an important niche in the desert life community, for it furnishes food and shelter for many creatures. Bats are important pollinizers. Insects, seeking nectar from the flowers, attract numbers of flycatchers. The ripening fruits are eagerly consumed by birds, including white-winged doves, which also obtain nectar from the blossoms. Fruits that fall to the ground are eaten by rodents, coyotes, and other earthbound animals. A heavy toll of the seed crop is taken by ants. Nest pockets are drilled in the spongy stem tissues by Gila woodpeckers, and hawks and owls build their bulky nests in the forks of the branches. An insect-carried bacterium produces a necrotic disease that has killed many saguaros in overage stands.

Until recent years, saguaro fruits formed an important item in the diet of desert Indians and are still harvested in some areas. The Papagos considered them so important in their economy that they established the harvest season as the beginning of their new year. Skeletal poles, or ribs, of dead saguaros were used by early settlers in building shelters and fences. The saguaro blossom has been adopted as the State flower of Arizona, and the plant's unique silhouette is considered a trademark of the Southwest.

Great horned owl, shown here by a pool at night, often builds its nest in the forks of a saguaro.





A large group of joint-stemmed cactuses, which grow in the form of large shrubs or small trees, are called chollas. Similar in general appearance, they still present striking differences that interest both the veteran cactophile and the desert neophyte. Largest of these cactuses is the Sonora jumping cholla, also called tree cholla, which sometimes attains a height of 12 feet. The sturdy trunk and thick candelabra-like branches form an irregular open crown of densely spined joints.

Joint connections are so brittle that a person or animal brushing even lightly against the spine tips carries away a piece of the stem. So light a touch is required that some persons have declared that the joint actually leaped off the plant to imbed its spines in their clothing; hence the name "jumping cholla." Another name, chain-fruit cholla, refers to the chainlike hanging clusters of previous years' fruits. Flowers, which are small and pink, form on the pendant fruit clusters.

Much smaller than the Sonora jumping cholla but even more conspicuous because of its compact growth and extremely dense armor of straw-colored spines is the Arizona jumping cholla, also called silver cholla and Teddybear cholla. This usually grows in miniature forests on south- or west-facing slopes. The easily overlooked flowers, which are yellowish green, open from March to May. The short joints fall around the base of the plants, where they take root in sandy soil. Those that roll downhill or are carried some distance from the plant by water, wind, or animals may become established and help to extend the area covered by the pygmy cholla forest.

Several small species of cactus, called pencil chollas, are found mingling with the tangle of growth along margins of washes. Most noticeable among these is the tesajo, or Christmas cholla, whose bright-red fruits persist throughout the winter.

Sometimes expanding into large and conspicuous clumps, the cactuses with broad, flat, leafless joints, or pads, are called pricklypears. Prickles are of two types: long stiff spines, and clusters of small, usually brownish, hairlike barbs.

Dense stands of Arizona jumping cholla (above) form miniature cactus forests. The plant's yellow-green blossoms (lower right) are protected by a thicket of silvery spines. A close relative, the Sonora jumping cholla (lower left), has persistent fruits that have given it the local name of "chain-fruit cholla."

Largest and most spectacular of the many flat-jointed cactuses is the Engelmann pricklypear. It has jointed stems that may reach 5 feet in height, and it grows in clumps which may become 10 to 15 feet in diameter. Blossoming in April-May, the flowers are large and numerous and have bright-yellow petals. They mature in autumn as reddish-purple fruits, called tunas, which are eaten by skunks, coyotes, birds, and other animals. The fruits, enjoyed raw by the Indians, make delicious jelly.

Sometimes mistaken for a young saguaro, the California barrelcactus, or "bisnaga," may be identified by the stout reddish central spine in each cluster which curves at the tip, resembling a thick-shanked fishhook. The blossoms, which are yellow or orange, develop in an open-centered cluster on the crown of the plant from April to June. The pale-yellow fruits, about the size and shape of a small hen's egg, ripen in early winter and are eaten by deer, rodents, and birds.

Among the small ground-hugging cactuses there are several groups, some of their representatives so tiny as to be overlooked except when in blossom. These are known as the fishhook, pincushion, and hedgehog cactuses. Largest are the hedgehogs, among which the Engelmann echinocereus is widespread and has several variants. Fruits of some species are about the size of strawberries and are juicy and edible. The plants bloom during March and April, their large flowers making bright spots amid the low-growing desert vegetation. Petals vary in color from lavender to deep-purple and magenta. The plants consist of small, open clumps of cucumber-shaped stems, 6 to 12 inches tall, with long, strong spines.

Nonsucculents

The nonsucculent trees and shrubs compete with the succulents and often hide them with their more luxuriant growth. They provide an open but continuous cover on the bajadas and rocky hillsides of the outlying ridges and the lower slopes of the mountains. Here ocotillos mingle with saguaros and organpipes. The shrubby yellow (foothill, or little leaf) paloverde is

(Above) Blossoms of the barrelcactus encircle the crowns of the heavy-bodied plants. (Below) Blue paloverde trees usually grow along the borders of desert washes.



particularly noticeable because of its yellow-green bark and long, usually leafless, pendant twigs. The bark of limbs and twigs assumes the function of foliage in dry weather, with little loss of moisture. The yellow paloverde, with its lighter color, smaller leaves (which it loses early in the summer), and paler yellow flowers, differs somewhat from the larger blue paloverde. Both are members of the pea family.

The blue paloverde prefers the more dependable supply of moisture found along washes and drainage channels, where it often attains a height of 20 to 25 feet. Near the mouths of mountain canyons, the two species may be found growing side by side, their dense mantle of yellow blossoms from March to May helping to extend the spring flower season and marking each watercourse with a ribbon of gold.

Even before the paloverdes start to bloom, rocky ridges and boulder-strewn hillsides begin to glow with the yellow, sunflowerlike blossoms of white brittlebush. The blossoms rise on erect stems to form a thick canopy of bloom above the ashy foliage. Brittlebush is one of the most conspicuous low-growing shrubs of the desert hills and mountains. Even after its blossoming season ends in May, it flaunts an abundance of showy gray-green leaves. The brittle stems exude drops of thick sap, which harden and were chewed by the Indians. In pioneer days, this material was gathered by priests and burned as incense in mission churches; hence the local name, "incienso." The leaves are browsed by bighorn.

Another attractive and interesting shrub, or small tree, of the bajadas is the jumping-bean sapium, a close relative of the Mexican jumping-bean. Its willowlike leaves seem out of place in desert surroundings. The milky sap contains an irritant that is said to have been used by Apache Indians to poison their arrow points. The rather inconspicuous flowers bloom from March to November.

Sometimes called deernut, the California jojoba is an attractive evergreen shrub usually 4 to 5 feet high with thick gray-green leaves. It is abundant on foothill slopes and along washes, especially in canyon mouths, and provides excellent browse for deer. Its fruits, which are about the size of small almonds, are edible and were eaten raw or parched by desert Indians. They contain tannin, which gives them a somewhat

Brittlebush flowers brighten rocky hillsides in early spring.





bitter taste. Early settlers boiled them as a coffee substitute. These "nuts" are rich in a liquid wax chemically similar to sperm whale oil.

Also of value as browse to deer and reportedly to bighorn is longleaf ephedra, or "Mexican tea." This plant is noticeable because of its lack of conventional leaves and because of the dense, bushy growth of erect, jointed, green to yellow-green stems. Early settlers made a palatable drink by steeping the dried stems and flowers. Clusters of small yellow blossoms, abundant in the spring, attract insects.

Wolfberry (graythorn, or desertthorn) grows as a shrubby tangle of stiff branches and spinelike twigs, which provide ideal cover for coveys of Gambel's quail and other birds. The plant leafs out with the winter rains, and it flowers from January until April. The pale purple blossoms mature to form small red fruits, or "tomatillos" (little tomatoes), eaten by birds and mammals and, in the past, by desert Indians. Wolfberry, of which there are several species in the monument, sheds its small fleshy leaves during periods of drought but refoliates quickly after a rain, sometimes producing a second crop of flowers.

A low-growing shrub, the falsemesquite calliandra, or fairy duster, covers rocky slopes with its feathery blossoms of pink and white in the early springtime.

Relatively rare in the monument, but occasionally found on rocky slopes of the southern end of the Ajo Mountains, is the grotesque bursera, or elephanttree. This shrubby tree, easily frosted, is another of the Mexican forms at home in limited localities north of the international boundary where temperatures remain high the year around. The stem is short but thick and the crooked branches taper rapidly, their shape suggesting the trunk of an elephant. The bark is thin, a papery whitish outer coat covering an inner green layer over a thicker red underbark that exudes a blood-red sap if broken. The July-blooming flowers are small and inconspicuous.

Short-Lived Annuals

When normal or above normal winter rains keep the desert soil moist for months, and when no late cold spell and no persistent drying winds blight the lavish growth which ensues, then

Delicate pink and white blossoms of falsemesquite calliandra, or fairy duster, decorate the slopes from February to May.

ephemeral (short-lived) annuals cover the desert with a gorgeous patchwork quilt of bloom. Beginning as early as mid-February with desert sandverbena and Mexican goldpoppy, the spreading patches of color reach a peak in late March and early April. Shreve lists more than 150 species of these winter ephemerals common in the Sonoran Desert.

Some of these plants, one must remember, are not adapted to true desert conditions, but they take advantage of the favorable combination of moisture and temperaure which prevails only during a cool, wet winter. Thus they are able briefly to monopolize the soil and, by compressing their growing season into a few weeks, to mature their seeds before the desert summer turns on its heat.

During the hot, dry periods of the year, the tiny seeds of these plants lie mixed with the soil. They are ready, when suitable conditions return, to germinate and start a new generation. This may not come about for a number of years.

"In dry years," writes Dr. Fritz W. Went of the Missouri Botanical Garden, "the seeds of certain annual plants lie dormant. This is not remarkable; what is amazing is that they refuse to germinate even after a rain, unless the rainfall is at least half an inch. The mystery is explained by the fact that some seeds have water-soluble germination inhibitors in their coverings. Rainfall in sufficient quantities to support the potential seedlings dissolves the coverings—anything less leaves the seeds dormant to await adequate moisture." When winter rains are scant or lacking, the seeds do not germinate, and the spring flower display fails to materialize.

The winter ephemerals, however, are not the only set of short-lived annuals. Another group blooms in summer. Thus the annuals respond to the two seasons of possible rainfall, December through February and July through September.

For the native perennials, there are also the two seasons of growth. The lesser one is in early spring, following winter rains and the rising temperatures. The major one occurs during the summer rainy season. The entire ecology of the perennials is adjusted to the summer rainfall.

Among the more than 150 species of winter annuals that spread their colors across sloping bajadas and along washes, a few produce the major part of the spring flower show. Sometimes a single species covers a relatively large area with a vivid mass of blossoms of one color; again two or three species mix to pro-

duce a bright yet harmonious blending of brilliant hues. In other sections of desert a general mixture of ephemerals develops. These do not all blossom at the same time; hence the pattern of color changes from day to day as the flowers of each plant, under the pressing urge of warm, drying breezes, develop rapidly toward the seed stage. Adding to this glorious display of annuals, the less hurried spring-flowering perennials join the blossom parade at overlapping intervals.

The more conspicuous spring ephemerals that combine with or follow the goldpoppy and sandverbena in developing mass displays are the purple-flowered escobita owlclover; several species of blue to violet lupines; the ground-hugging nama, or purple roll-leaf; and the evening-primroses, or sundrops.

Properly belonging with the perennials, but noticeable only during its spring blossoming period, the desertlily is among the most attractive of the monument's wildflowers; it resembles an Easter lily. The bulbs once were important in the diet of Papago Indians and, because of their similarity to garlic, were named "ajo" by the early Spaniards. This plant, abundant in the region, has given its name to a town, a valley, and a range of mountains—all of which are prominent in the geography of the monument.

Abundant along roadsides, the yellow-petaled desertgold, or desert-sunflower, blossoms from January to June and attracts moths and butterflies. The tackstems are not abundant, but they are noticeable because they grow in robust white, rose, or pale-yellow clumps that somewhat resemble long-stemmed dandelions. Easily confused with them is the desert-chicory. Several species of phacelia, or wild-heliotrope, add to the monument's flower show. These plants, with white to violet or purple flowers, are usually found under shrubs and bushes rather than on the open desert.

The flowers of the globemallows, whose colors are usually grenadine, apricot, or orange, also attract attention. Many of the species are perennial and hence may be found in blossom throughout much of the year. Some annual species are small and erect and have large blossoms. Often growing along roadsides, they create bright-colored patches in early spring. Several of the perennial globemallows are tall, coarse, and conspicuous when covered with flowers. Globemallows may be found in bloom during periods when other flowers are conspicuous by their absence, and they help to fill the flowerless gap after the



winter ephemerals have faded and before the cactuses and summer perennials are ready to blossom.

According to Shreve, the fast-growing herbaceous plants which appear after the spotty summer rains begin are as abundant and ubiquitous as the winter ephemerals. The seedlings become noticeable about 3 days after the first heavy downpour and soon carpet gentle slopes where the soil surface has been bare for months. In the Arizona upland there are few years in which starting conditions are favorable before July 10. Grasses are more richly represented in summer than in winter, both in species and number of individuals. There are fewer species of summer ephemerals than of winter ephemerals, but their role in the desert ecology is just as important.

Few of the hot-weather ephemerals develop mass displays or furnish the attractive color combinations provided by the cool-weather annuals, but a sufficient number of them are usually present to provide bright spots for the visitor who is willing to brave the summer heat. One of the more noticeable representatives of the group is the caltrop, or summer-poppy, whose large blossom somewhat resembles that of the Mexican gold-poppy. Its local name is Arizona-poppy.

Even during the driest years, desert baileyas, or desertmarigolds, may be found, often near washes or along roadsides where pavement runoff provides additional moisture. The large yellow flower heads are readily recognized. Salt heliotrope, or quailplant, blooms throughout the year when moisture is adequate. Flowers are white to purple. Indians dried the roots and applied the powder to wounds and sores.

Spiderlings prefer open, sunny locations, where their trailing stems spread over the sandy soil. The purple flowers are small but grow in attractive clusters. Other common summer ephemerals, widespread but lacking noticeable flowers, include amaranth, or carelessweed, and spurge, of which there are many species. Pectis, or chinchweed, is another member of a big genus, a number of species of which are hot-weather annuals. Following summer rains, large areas may be covered with the small yellow flower heads of this strong-smelling plant. Indians are reported to have used it for seasoning foods.

(Left) Widespread and easily recognized, desert baileya may be found in bloom during any month of the year. (Right) Desertlily is one of the attractive flowers of early spring.



Higher Elevations

BOTANICALLY UNEXPLORED

Datil yucca (above) and Schott agave are two interesting plants of the upper slopes. Desert Indians once used the yucca's leaf fibers in weaving coarse fabrics, and they still eat the roasted fruits. Below, a long-nosed bat sips nectar from agave blossoms.

ACCESSIBLE BY ONLY a few unimproved trails, the rugged upper slopes of the Ajo Mountains and Growler Mountains have been visited principally by Indians, local stockmen, park rangers, and rock climbers—and not many of them. Reports regarding the vegetation are correspondingly scarce and meager. The steep and rocky nature of the terrain provides little opportunity for plant growth, and lack of moisture further restricts the vegetative cover.

None of the mountain ranges are high. Santa Rosa Peak, in the Ajos, highest mountain in the monument, rises to only 4,829 feet. Kino Peak, tallest in the Growlers, is only 3,057 feet high. Elevation in the monument, therefore, although influential, does not have as much effect on climate and hence on plant and animal life as it would if the mountains were higher.

Occurring as scrubby individuals or in small thickets, the common one-seed juniper is found on the slopes of higher mountains in suitable locations.

On dry, sunny benches of the Ajo Mountains around 3,000 feet are occasional colonies of the rather rare Schott agave, or centuryplant, reaching here the western limit of its known range. One of the leaf succulents, the centuryplant derives its name from the fact that many years are required for it to store enough food in its thick rootstock to produce a rapidly growing blossom stem and dense head of flowers. Completely exhausted by this supreme effort, the plant dies after the seeds have matured. This species is reported to be pollinized by the long-nosed bat.

The Ajo and Growler ranges provide a variety of habitats for groups of plants requiring special conditions of shade, moisture, exposure, and slope that are found only in mountain canyons of desert regions. One of the not uncommon associations of

desert-mountain plants is the oak-gooseberry-penstemon community.

Oaks in the monument include shrub live oak, gray oak, and the rare Ajo oak. Gray and shrub live oaks, which are similar, form thickets on moist, protected, usually north-facing canyon walls along with the evergreen shrub, Torrey vauquelinia, or Arizona-rosewood. Mingling with these is the lower-growing oakwoods, or yellow-flowered gooseberry, which blooms from November to April. Taking advantage of shade provided by thickets of either juniper or oak, the littleleaf penstemon, or yellow beardtongue, brightens mountain slopes from March to May.

On the more exposed higher slopes of the mountains, the datil yucca occasionally may be found, often associated with scrubby junipers. In April-May this wide-leafed member of the lily family produces short robust stalks of creamy bell-like flowers. These mature to large pulpy fruits, which are relished by rodents and other animals. Because its roots contain saponin, the yucca is sometimes called soapweed.

Five species of ferns have been recorded in the monument: one each of lipfern, goldfern, and cliffbrake, and two species of cloakfern. All of these are found in relatively dry, rocky locations at elevations (except the cloakferns) from 2,000 feet to the tops of the mountains.

A host of shrubs grow in tangled profusion around occasional seeps in the canyon bottoms. A variety of shrub species is also found on the mountain slopes where there is enough soil to hold the roots. Some furnish browse for deer and bighorn, while others provide shelter for birds and small mammals. Among the common shrubs are redberry buckthorn, Mexican condalia (bluewood), skunkbush sumac, Texas mulberry, spiny hackberry, and desert-olive forestiera.



Wet Habitats

The pond at Quitobaquito.



IN AN ARID REGION, the few permanent springs, seeps, and natural tanks, or tinajas (potholes), provide oases where you will find species requiring an abundance of water, complete strangers to a desert environment. Also in these spots, some of the usual desert forms become unnaturally rank and luxuriant, and they show other interesting changes when their bases are in water. Desert waterholes thus present a special field for study.

Only a dozen or so such water sources occur in the monument, the largest being a shallow pond, the accumulation from warm springs, at Quitobaquito near the southwestern corner of the area. Here a number of trees have become established, birds are abundant, and a border of shrubs, inland saltgrass, flat-sedge, and Olney bulrush presents a picture quite unlike that of the desert surroundings. A large, leaning cottonwood shades the west side of the small pond and provides a choice of perches for vermilion flycatchers which sally forth at intervals to snap up insects hovering over the water. Plants that grow in the water monopolize the shoreline, furnishing cover for coots, wild ducks, and other waterfowl that make rest stops at this tiny oasis during migrations. Seepwillow baccharis, tree tobacco, and arrowweed pluchea thrive in the water-soaked soil around the shores. The big saltbush and pickleweed, or iodine-bush, found at Quitobaquito represent species not known to occur elsewhere within 100 miles.

A small stand of cattails has taken possession at Rincon Spring, about 1½ miles northwest of Quitobaquito. At Dripping Springs and near seeps and ephemeral streams in the Ajo Mountains are verdant growths of small, moisture-loving plants. Among these, the crimson monkeyflower attracts hummingbirds with its bright blossoms from March to October.



Animals

Occupants of the monument campground often hear coyotes howling at night. *Courtesy, U.S. Fish and Wildlife Service.*

AS ONE ECOLOGIST has written, "The more than a million species of living things on this earth form an incomprehensibly complex and intricate pattern of life. The pulling of a thread here, or the cutting of a skein there, no matter how small, may cause knotting, warping, or even ravelling of the delicate fabric at some wholly unexpected place." Thus the intricate mingling of plant and animal life in the various habitats, themselves influenced by geological conditions of the monument, might be irrevocably altered by the continued interference of mankind. It is to prevent just such disturbance of the orderly balance of nature that this outstanding section of desert has been preserved through permanent protection.

Animals to a degree are dependent upon each other, upon certain plants, and upon climate and other natural factors favorable to their living requirements. They become established where these suitable conditions prevail and where other animals (and the plants essential to their welfare) are abundant. Thus, throughout the desert, there are extensive or restricted communities of plants and animals called biological associations. We may expand our understanding and enjoyment of the desert if we will look upon plants, mammals, birds, reptiles, insects, and all other inhabitants of the desert not only as interesting individuals but also as parts of a complicated and interdependent living whole.

We are already familiar with the fact that there are three subtypes of the Sonoran Desert represented within the monument, each with plant associations not found in the other subdivisions. Closer inspection reveals that these groups may include even smaller and more closely knit units, or microcommunities. For example, some plants support colonies of aphids, and certain ants collect the aphids' sweet exudations. There are even smaller organisms parasitic or dependent upon the ants.

Because of their greater mobility, many animals, especially the birds and the larger mammals, are not restricted to any particular environment and may be found among several distinct types of desert plant associations, sometimes frequenting one type during the winter and moving to another in summer. Both the turkey vulture and the black vulture are a common sight soaring over all parts of the monument or congregating, as if informed by built-in television, at the spot where a luckless animal has succumbed to thirst, famine, wounds, or the relentless processes of age.

Oases form a special kind of environment, for they are visited by many birds and mammals that make their homes in other habitats. Birds, especially, often come in large numbers. The 1½-acre pond at Quitobaquito, a dependable, year-round water source, draws hundreds of individual birds as well as a wide variety of species. As many as 400 white-winged doves may take advantage of the oasis during a single day in late May or June. Mourning doves and brown-headed cowbirds also come in numbers to drink and then rest in the shade among the branches of trees that border the pond.

Dr. Max Hensley, who conducted extensive studies of bird activity in the monument during 1948-49, reports a count of 477 individual birds, representing 22 species, at the pond in a single day. He recorded a total of 59 species at Quitobaquito. Most of these apparently came to the pond for refreshment, for only 15 species nested in the immediate vicinity. Of these, the killdeer was the only one apparently requiring the proximity of water for raising a family.

Among the winged visitors at the Quitobaquito oasis are shore and water birds that stop there for a few hours, or sometimes several days, during their cross-country migrations. These include grebes, herons, and wood ibises; mallard, teal, redhead, and lesser scaup ducks; coots, snipes, and 5 species of sandpipers. Even kingfishers have been recorded, their visits being explained by the presence of a small fish, the desert pupfish.

These little fish are slate gray except during the breeding seasons, when the bodies of the males become bright blue and the tails turn lemon yellow to orange yellow. Then, the males are noticeably active in defending bits of territory against other males. Of all desert fish, these are best adapted to endure temperature extremes from a few degrees above freezing to over 100° F., and they can live in water with relatively high salt content.

Black phoebes and vireos, warblers, and swallows of several species are among the birds attracted to the oasis by the abundance of dragonflies and other insects which find food or breeding sites in or around water.

Animals of the Open Desert and Its Drainage Channels

Like the doves that assemble daily at Quitobaquito for water, many mammals and birds travel a considerable distance to

springs, tanks, or seeps. Others, however, require less moisture, drinking infrequently or meeting their requirements from the moisture within the plants or animals that they eat. Several, of which the kangaroo rat is an example, obtain their water through processes of metabolism within their bodies by means of which dry foods are converted to essential moisture.

Kangaroo rats are nocturnal, remaining in their burrows during daylight hours. These burrows are frequently seen in open desert country, a number of openings often perforating a mound of earth around the base of a creosotebush. By remaining quietly underground during periods of high temperature and low humidity, kangaroo rats and some other rodents conserve moisture, escape heat, and avoid the searching eyes of hawks, coyotes, and other diurnal predators. They cannot, however, thus escape badgers, whose heavily clawed forefeet and powerful shoulders enable them to dig out their prey.

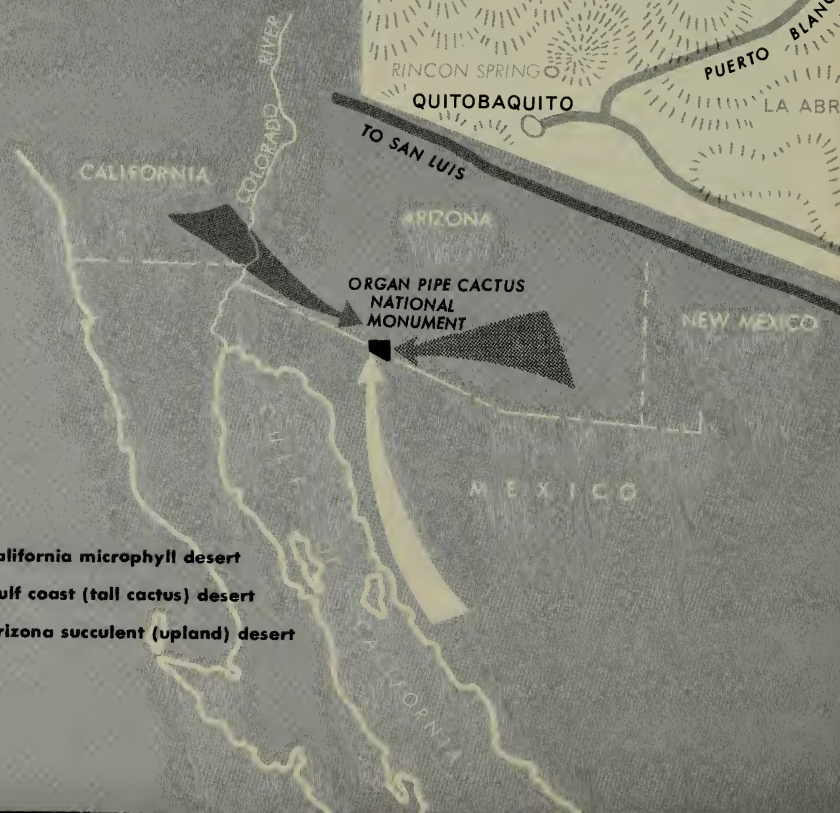
Kangaroo rats have small forefeet, which they use for digging and for stuffing food—principally seeds and other plant materials—into their fur-lined cheek pouches. Their hind legs and feet are large, enabling them to cover the ground in huge leaps when pursued by owls, foxes, snakes, and other nocturnal predators—their chief enemies.

In hot weather, snakes, including rattlers, do their hunting at night. Remember this if you are afoot in the desert after dark, and use a flashlight to illuminate the path ahead. During the day these reptiles remain quiet in deep shade or in rodent burrows, since they cannot endure extreme temperatures.

Another desert inhabitant, numerous on the creosotebush flats, is the round-tailed ground squirrel, which burrows in the sandy soil and climbs into shrubs and small trees to gather seeds and other plant parts. Usually active during the day, these squirrels disappear for several weeks during the hottest part of the summer, remaining inactive within the network of their underground tunnels. They also remain below ground during the coldest part of winter, although they may not hibernate. Slender-bodied snakes, such as the western red racer, are able to enter the burrows and feed on the young.

The rare desert pupfish (above) lives in the pond and springs at Quito-baquito. Round-tailed ground squirrels (below) are usually found on creosotebush flats, where their tan coats blend with the brownish soil.





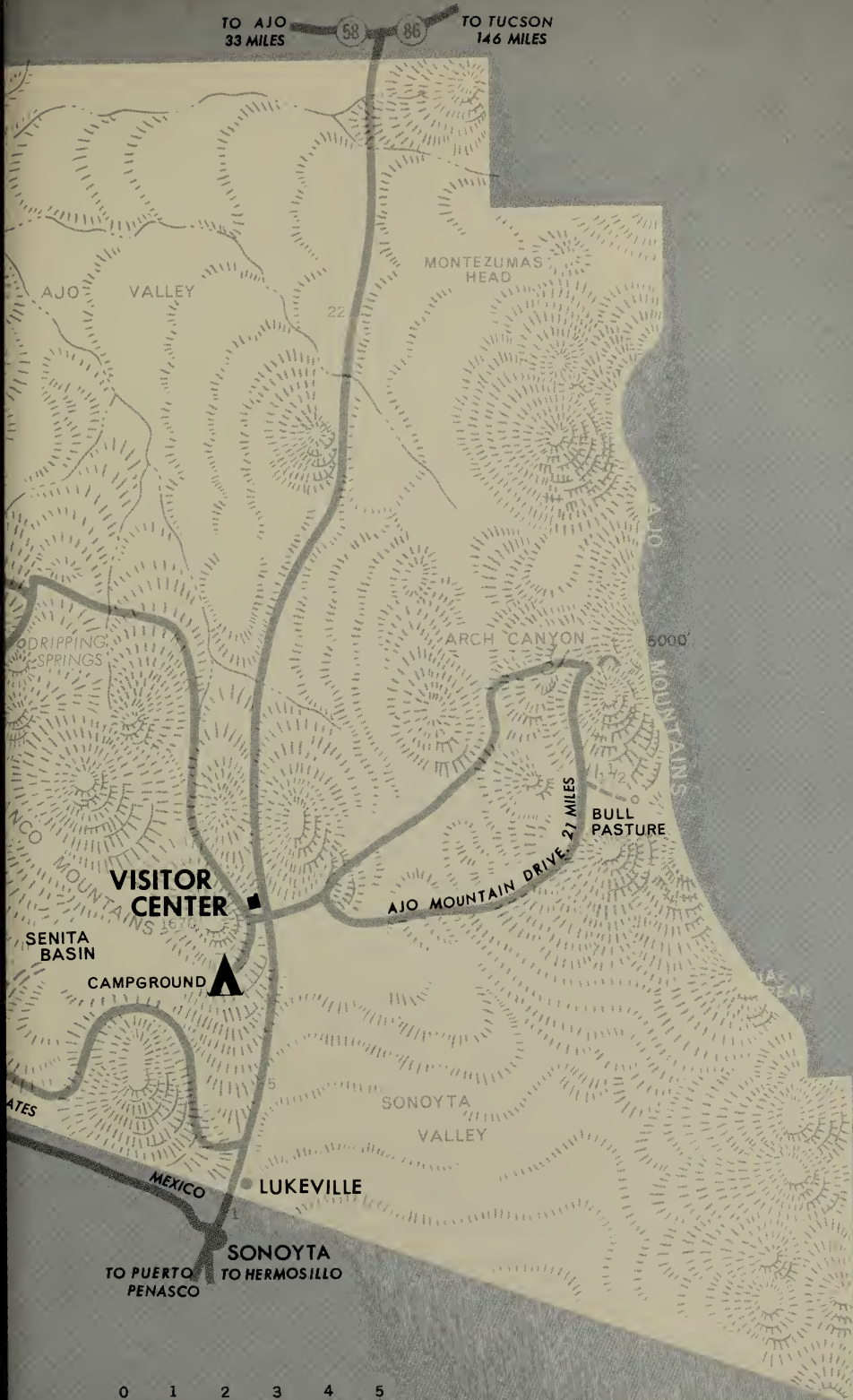
- California microphyll desert
- Gulf coast (tall cactus) desert
- Arizona succulent (upland) desert

TO AJO
33 MILES

58

86

TO TUCSON
146 MILES



0 1 2 3 4 5
SCALE IN MILES

JUNE 1964 RM ORG:17005

Airborne enemies of the ground squirrel include Swainson's hawks, golden eagles, and red-tailed hawks, which keep a keen watch of the ground as they ride the rising air currents over desert flats and bajadas. These big birds also feed on gophers, snakes, lizards, rabbits, and large insects such as grasshoppers.

Jackrabbits range widely in the monument and are not limited to any specific habitat. They are frequently seen in the evening or early morning on the open flats, where sparse vegetation makes them more readily visible. During the heat of the day they seek shade beneath shrubs and trees that border desert washes. Foxes, coyotes, hawks, owls, and other furred and feathered hunters prey upon them. They obtain much of their moisture from their plant food, sometimes gnawing into cactus stems to get at the succulent tissues.

An animal of the grasslands, the pronghorn is rare in the desert, but it is quite possible that you may sight one of the small bands that range over the western part of the monument and the adjoining Cabeza Prieta Wildlife Refuge. Fleet of foot and trusting to its sight to warn of an enemy's approach, the pronghorn prefers open country. It is known to eat saltbush and ephedra; it also eats pricklypear stems for the moisture they contain.

Sometimes at night the kit fox is seen crossing open flats or hunting among the shrubs bordering desert washes. This large-eared fox is the smallest of the canine predators. Subsisting principally on kangaroo rats, rabbits, and other nocturnal mammals, the kit fox also eats insects and an occasional reptile.

The sidewinder is a small gray rattlesnake, readily recognized by the conspicuous hornlike process over each eye which serves as a protecting ridge when the snake lies almost buried in the sand. This poisonous reptile can be identified by the looping motion which enables it to travel with ease over the sandy soil of its favored habitat. The sidewinder is rarely encountered because in warm weather it is abroad only at night. Its occasional tracks, looking like a series of parallel "J's" in the sand, are usually the only evidence of its presence. Sidewinders eat small mammals, nestling birds, and lizards.

Among the common lizards of the creosotebush environment is the insect-eating checkered whiptail, or racerunner, often found on the open flats far from water. Less common is the crested lizard, or desert iguana, which, when disturbed, usually runs a considerable distance to disappear into a bush from which

it emerges on the opposite side. If chased, it displays an uncanny knack of keeping a bush between itself and its pursuer. Food consists principally of plant material, including leaves, flowers, and fruits. Lizards and some snakes obtain necessary moisture from the body juices of their food.

One of the few birds which nest on the open flats is the attractive black-throated sparrow, found all year in the monument and identified by its black throat and white facial stripes. It also nests on bajadas among chollas and other plants.

Birds are more numerous in the sparsely vegetated creosote-bush flats in winter than in summer. Many of the smaller birds, such as the white-crowned and Brewer's sparrows, winter in the desert areas along the Mexican border, migrating northward in spring to their nesting grounds in the Great Basin and Rocky Mountain States. They find insects and plant food among the winter ephemerals that spring up on the open ground between creosotebushes. Other winter residents that go north in the spring are lark buntings, which usually travel in small flocks, sage thrashers, and chipping sparrows.

The thick cover, shade, and insect-attracting blossoms and fruits of mesquite and paloverde thickets form special environments along the banks of dry desert washes. Abundant vegetation furnishes food, sanctuary, and nesting sites for resident birds, as well as protected travel avenues for transient species. Many mammals and reptiles make use of them as hunting grounds or hiding places.

Desert cottontails are numerous throughout the desert country and up into the canyons and mountains wherever food plants are abundant and there is suitable brush for cover. These rabbits take advantage of the tender growth of both winter and summer ephemerals, resorting to twigs and bark of shrubs and trees and the stems of succulents when fresh growth is unavailable. They are preyed upon by snakes, hawks and owls, coyotes, bobcats, and foxes; hence they remain close to the protective cover of shrubs, thickets, and rocky outcroppings.

For much the same reasons, Gambel's quail frequent mesquite thickets where insects are plentiful and where their roosts are protected from winged and furred night predators. From these thickets they can range into the flats and bajadas to feed on perennial seeds or the greenery of alfilaria, spurge, spiderling, and other desert ephemerals.

Feeding on insects, nestling birds, small rodents, and fruits, the ringtail is a night prowler. It frequents the same thickets along dry washes and rocky canyons as the quail and the cottontail. A relative of the raccoon, the ringtail is easily recognized by its large ears and eyes and its long, fluffy, banded tail.

Consider yourself fortunate if you happen upon a band of peccaries, which are fairly abundant and are believed to be on the increase in the monument. They range through mesquite and cactus thickets during much of the year, principally in search of cactus stems and fruits, but also of herbs, succulent roots, mesquite beans, and insects. These piglike animals, commonly called javelinas in the Southwest, sometimes summer in mountain canyons, favoring oak brush where acorns later provide a welcome change of diet.

Insects are found everywhere throughout the desert. During the blossoming season, they are especially numerous along the washes where mesquite, catclaw acacia, paloverde, and tesota trees are laden with nectar-producing flowers. Among the hundreds of species of insects whose wings fill the air with the hum of activity, honey bees are much in evidence. Not native to the monument, they have become naturalized here and have established colonies in caves and crevices in the basalt cap rock. Bees and other insects may be found in numbers around seeps and springs where they obtain water, but they get much of their moisture from the nectar of flowers and the sap of plants.

The body fluids of insects in turn provide vital moisture for birds and for reptiles, such as the Arizona zebra-tailed lizard, which frequent sandy washes. Extremely sensitive to temperature changes, these lizards bury themselves in the sand at night. During early morning and late afternoon, they are active in the sunshine, but in the heat of the day they seek the shade of paloverde and mesquite trees and shrubs that line the flood-stream channels. When motionless, they blend inconspicuously into their surroundings. If disturbed, they curl their black-banded tails above their backs and race away. L. M. Klauber, formerly of the Zoological Society of San Diego, considers this

It takes some luck to see this trio of monument animals. The horned rattlesnake, or "sidewinder," and the ringtail (lower left) hunt by night. Peccaries, believed to be increasing, range in bands through mesquite and cactus thickets.





species the speediest reptile of the desert. He has clocked it traveling at 5 times the speed of the fastest snake.

The Sonora spiny lizard is usually found on the trunks or branches of trees, but sometimes it descends to the ground to forage for insects, ready at any moment to rush for cover at the approach of an enemy.

In addition to the many birds which frequent mesquite and palo verde thickets in search of food or shelter, a number of species, including doves, find nesting sites in the trees and shrubs along the borders of desert washes. Among the smallest of these birds are the vivacious verdins and the sprightly gnat-catchers. The former, identified by the dull-yellow head and reddish-brown shoulder patch, construct globular nests about the size of a large coconut, with the entrance partially underneath. Verdins eat insects when they are available and subsist on fruits and seeds in winter.

Not common, but so colorful as to attract immediate attention, are the cardinal and the pyrrhuloxia, both of which are year-round residents. Both have conspicuous crests. Cardinals are brighter red and less chunky in appearance than pyrrhuloxias, which are a blend of red and gray.

Animals of the Succulent Desert

Among the commonest birds of the desert are the thrashers, of which there are several species. Since most of them are year-round residents, they breed in the desert environment, building rather shallow, loose nests of twigs, usually lined with rootlets, in mesquites, shrubs, or cholla.

The thicket-loving crissal thrashers, largest of the group, have long, curved bills. They are delightful songsters, although the song is neither loud nor varied.

Curve-billed thrashers prefer the more open upper bajadas. There they may be seen and heard among the chollas and organpipes along the bases of the mountains and in the mouths of canyons, their favorite nesting sites. Among their companion songsters are mockingbirds and house finches.

Phainopeplas are particularly noticeable in winter, when they frequent the succulent desert. Their prominent crests and the

The Sonora spiny lizard prefers rocky localities or tree-grown banks of desert washes.

silky black plumage and white wing bars of the males arouse the curiosity of persons unfamiliar with these charming residents. During the nesting season, these birds are much less in evidence, being busy rearing young among the mesquites along the dry wash borders. Mistletoe berries are among their sources of food and moisture.

Cactus wrens build globular nests in chollas and make their presence known with their harsh, unmusical songs and chatter.

Nearly everyone is familiar with that desert clown, the road-runner, whose ruffled appearance, awkward gait, and unorthodox food habits set it apart. These peculiar birds prefer to remain on the ground and will rarely fly unless closely pursued. They forage widely among the desert plants in search of insects and spiders, reptiles, young birds and rodents, cactus fruits—almost anything edible. They usually conceal their bulky twig nests in the center of a bush or low tree in dense thickets bordering sandy washes.

Several species of birds make use of nest pockets in the pulpy stem tissues of the giant saguaros. Among these are Gila woodpeckers and gilded flickers. As secondhand homes, these pockets are in considerable demand by tiny elf owls and ferruginous owls, which use them for sleeping retreats during the day, and by sparrow hawks that raise families in them.

Although not limited to saguaro forests, the sparrow-sized elf owls, smallest of the nocturnal predators, are more numerous where the big cactuses are abundant. They depend largely upon insects for both food and moisture. During the serenity of the desert twilight, these tiny creatures are active in the vegetation, their tremulous whistling notes adding to the beauty of the night.

Building their bulky stick nests in the forks of saguaros, the desert's large winged hunters—the redtailed hawk by day and great horned owl by night—between them keep up a 24-hour patrol on the search for reptiles and small mammals. The owl is a major influence in controlling skunk populations, the big night hunters seeming to be unaffected by the odorous musk.

Because they live only where they can find water, skunks are not found in many parts of the desert. Where water is available, several species, including the common striped skunk, may be present. Both the hog-nosed skunk and the hooded skunk occur along the Mexican border. The small spotted skunk prefers rocky hillsides, and it is rarely encountered on the open



The saguaro cactus plays an important role in the lives of several species of birds. Gila woodpeckers (lower left) drill nest holes in the trunks. Elf owls (above) often sleep during the day in abandoned woodpecker holes. Whitewinged doves (below) obtain nectar from the blossoms and feed on the ripe fruits. Building conspicuous stick nests in forks of the branches, red-tailed hawks and horned owls are among other birds that take advantage of the saguaro's hospitality.





desert. Hunting at night, skunks are seldom seen by monument visitors, although they occasionally disturb campers. Their food consists of insects, mice and other small rodents, reptiles, bird eggs, and cactus fruits.

The badger, a close relative of the skunk, is occasionally seen, but its presence in the desert is usually revealed by fresh piles of earth at the entrance to holes, about 1 foot in diameter, which it digs when seeking rodents, its principal food.

Since many of the small animals of the succulent desert are abroad only at night, the uninformed visitor may be disappointed because he failed to see any during a drive through the monument. This lack is especially noticeable during hot weather, when even those mammals which are normally active during the day seek shade or remain underground, where lower temperatures and slightly higher humidity reduce the animals' loss of precious moisture.

Several species of scorpions may be encountered hunting at night or hiding during daylight hours beneath a rock, under the bark of trees, or even inside houses. The majority are not dangerous although they can inflict painful stings. Stings of two small species may be fatal to children 4 years old or younger, and so great care should be exercised to protect cribs and playpens from invasion by scorpions.

Some of the nocturnal creatures, such as the white-throated woodrat, leave ample evidence of their presence although they remain under cover during the day. Woodrats, sometimes called packrats or traderats, build piles of desert debris, especially cactus joints, which are often seen among rocks or in cholla thickets. Within these armored mounds, the rats maintain intricate tunnels and runways and raise their young in well-protected nests. The cone-nose, a parasitic insect which infests woodrat nests, sometimes during May and June invades human habitations and may inflict an unpleasant and sometimes serious bite.

Active among stands of dead chollas, roots, and other wood materials, the so-called white ants, or termites, live in small underground colonies. When they invade woody material above ground, they build earthen travel tubes and cover the

(Above) Badgers hunt the hard way, digging their prey from underground burrows. (Below) Bobcats are night prowlers, but they are sometimes seen in early morning and late evening.

sites of their activities with a plastering of mud, for it is their habit to work in darkness. The presence of earth-plastered stems of dead chollas may attract your attention to the activities of these insects.

Visitors to the monument who have the time and equipment to use some of the less-traveled roads, and who can be in the extensive back country in the early morning or around sunset in winter, may expect to see some of the larger mammals. Among these, the mule deer finds browse shrubs on the succulent desert bajadas, along the desert washes, and among the rocks of the foothill slopes and canyon mouths. During the hot part of the year, deer may be found among the oak thickets on the slopes and upper canyons of the Ajo and Growler Mountains.

The gray fox is generally nocturnal in its habits. It roams widely throughout the desert and over the mountain slopes. It is probably the most abundant and widespread of the monument's canine predators and is not infrequently seen by visitors in the beams from their automobile headlights. The diet of these attractive animals consists of woodrats, mice, rabbits, and other small creatures, including an occasional snake, lizard, or bird. Gray foxes sometimes retreat during the heat of the day into the lower branches of a mesquite or paloverde tree.

Coyotes are roamers and cover a great deal of desert in their search for food. Their diet consists of rodents and other small animals and also considerable vegetable matter. Coyotes are also found throughout the mountainous parts of the monument wherever food is present. Although they are abroad at all times, they are usually seen and frequently heard during the hours around sunrise and sunset. You may be fortunate enough to see one at almost any time or place in the monument.

Bobcats are sometimes seen along desert washes and among the cactuses on the bajadas, but they prefer the rough and rocky terrain of the hills, mesas, and mountain canyons. They are active both day and night but are most often seen at dusk. They capture birds, desert rodents, rabbits, and other small animals for food.

Among the many species of lizards and snakes that inhabit the succulent desert, two perhaps are of general interest—the western diamondback rattlesnake and the Gila monster. The diamondback is the poisonous snake which may possibly be encountered, although the chance of seeing one is slight. During



These desert creatures have varied means of defense. The desert hairy scorpion (upper left) can inflict a painful but not dangerous (to humans) sting. The large black-and-coral gila monster (upper right) has a poisonous bite. Sinister-looking but harmless, the chuckwalla (below) wedges itself in a rock crevice when threatened.

summer, these reptiles remain quiet throughout the day, coming out to hunt at night. Persons having occasion to walk in the desert at night should use a flashlight to avoid coming upon a rattler unawares. Climbers should always look before placing a hand on a rock or ledge. These snakes are alert and will often assume a defensive coil when approached. Their principal food consists of rabbits and small rodents; occasionally they catch a bird.

The Gila monster, the only species of poisonous lizard found in the United States, is sometimes met as it ambles across the desert floor. These large black-and-coral reptiles, which may attain a length of 2 feet, should never be teased or handled. They usually try to escape when approached, hurrying to gain the protection of a low-growing shrub or to crawl among the stems of a cactus. They are fond of eggs and will raid the

nests of ground-dwelling birds. They are reported, also, to eat small rodents, nestling birds, and occasionally a smaller lizard.

Animals of the Canyons and Mountains

Another heavy-bodied lizard found in the monument is the chuckwalla. Buff to slate colored, it prefers rocky locations and is usually found about the mouths of canyons or on slopes or mesas where there are large boulders or ledges. Unlike most reptiles, the chuckwalla is a vegetarian, feeding upon tender leaves, flowers, and fruits. Its chief method of defense is to attempt escape by crawling into a crevice among the rocks, where it inflates its lungs, thus wedging itself tightly. If cornered, it lashes at its tormentor with its stout tail. Chuckwallas are preyed upon by hawks and coyotes; Indians at one time considered their flesh a delicacy.

Some desert mammals and birds move up into the mountains in summer, thus escaping the intense heat of the lower levels and finding food more abundant. Others, such as the bighorn, prefer the higher parts of the mountains all year, but they are occasionally seen crossing the wide desert valleys apparently en route to another mountain range. These animals are timid and, because of the inaccessibility of the higher parts of the rugged Ajos and Growlers, few persons have had an opportunity to study them in these native haunts. The bighorn, one of the Southwest's most spectacular large mammals, finds refuge and suitable habitat within the monument and in the Cabeza Prieta Wildlife Refuge, which adjoins it on the west.

Another mammal occasionally seen at higher elevations is the Arizona form of the white-tailed deer, or Coues deer. Smaller than the mule deer of the cactus desert and mesquite-bordered washes, the white-tailed deer favors oak thickets and brushy canyon slopes, where it browses on various shrubs and small trees. It is especially fond of acorns.

Frequenting moist locations in mountain canyon bottoms are two small amphibians. The red-spotted toad is active principally at night, but it is sometimes found abroad during the day. The high-pitched cricketlike trill of the male is a pleasant spring and summer-evening sound along canyon bottoms in the Ajo Mountains. The black tadpoles of this species are noticeable throughout the summer wherever there are shallow pools. The Couch's spadefoot, another toad, frequently breeds

in temporary puddles during the summer rainy season. Following rain, the adults are sometimes seen during the day although they are normally nocturnal. Like all toads, they are insect eaters. The tadpoles are an iridescent coppery bronze color, shading to black.

In winter, the small, sprightly rock wren inhabits rocky outcroppings in the creosotebush desert and broken lava boulders on cactus-studded slopes of mesas. When summer comes, it moves to dry, open mountain slopes, where it nests on ledges or on the ground in clefts between boulders. These cheerful little insect eaters seem quite unafraid of humans. They often may be approached closely and will come to their nests to feed their young when people are near.

About the same size as the rock wren, the rusty, brown-speckled canyon wren is shy and prefers steep cliffs and deep, rugged, shady canyons. Often heard but seldom seen, it has a loud, clear whistle that trips down the scale in a series of rapid notes, attracting immediate attention. Cave mouths and shelves beneath overhanging rocks are its favorite nesting sites.

A bird of the oak thickets and brushy mountain slopes is the big, fluffy brown towhee, which stays at the higher elevations throughout the year. These birds are ground dwellers, scratching noisily among dead leaves in the thickets. They usually build nests in low shrubs or cactuses.

Although no nests have been reported, the Cooper's hawk probably breeds among the cliffs and canyons of the Ajo and Growler Mountains. These swift, powerful predators feed on other birds, which they catch in flight, and on rabbits and other small mammals. Preferring the rugged crags and canyons of mountain terrain, they often invade the lower areas where doves, quail, and other large birds are more abundant.

Ground squirrels, woodrats, rabbits, and many other species of small mammals, reptiles, and birds inhabit the mountainous parts of the monument, but nothing definite is known about them locally because few observations have been recorded and no extensive studies have been made within the monument. Although the area was among the first on the continent to be explored by Europeans, it is among the last to be studied scientifically. The mountainous parts offer unlimited opportunities for investigation, the first step of which should be the compilation of an inventory listing the many forms of plant and animal life to be found there.



The Land

AND ITS FORMS

The Agua Dulce Hills (above) are the heavily eroded, granitic remnant of a very old range. Thick layers of volcanic material compose the Ajo Mountains (below).

Growler Mountains

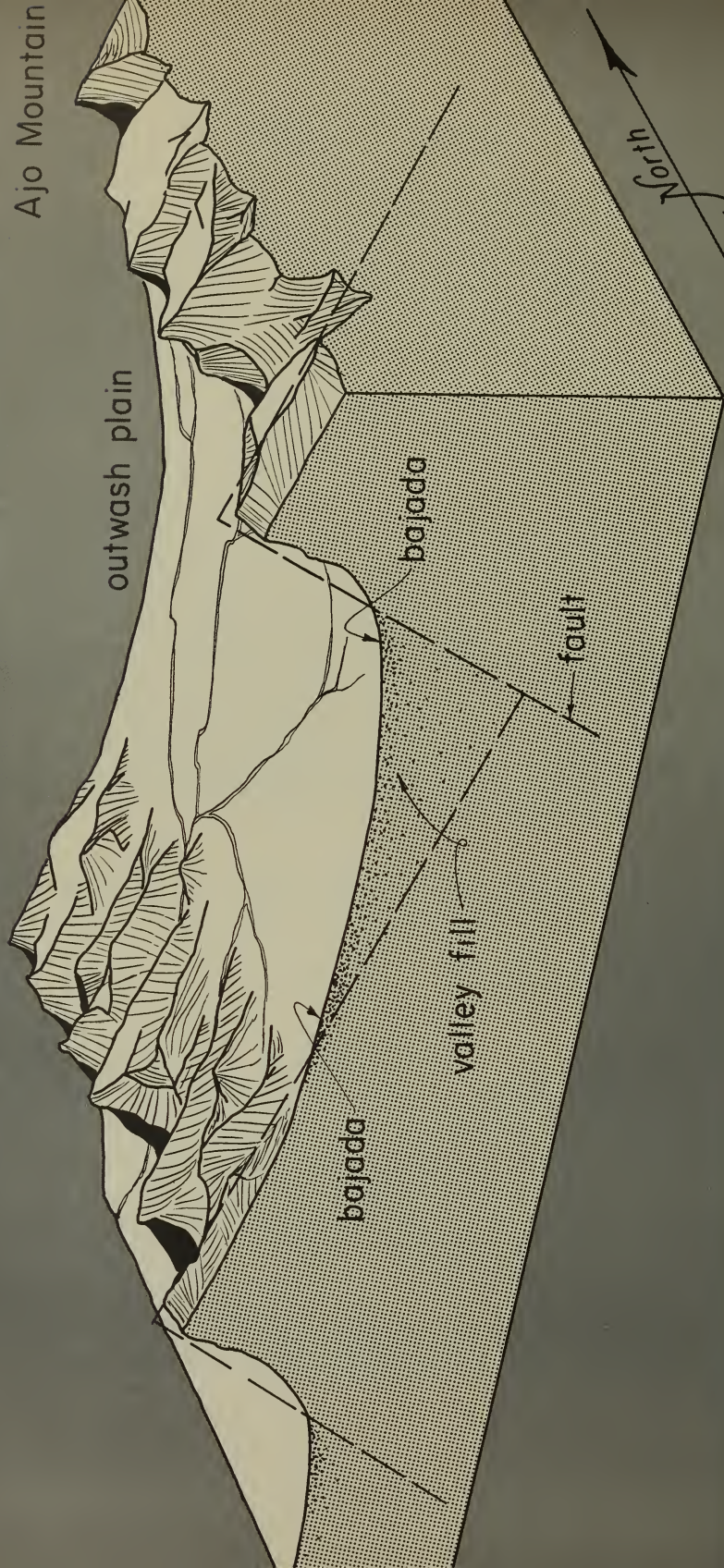
Ajo Mountain

outwash plain

bajada

fault

North



TIME AND CLIMATIC forces have long been at work here sculpturing the earth to form today's scenery and providing soil, slope, and exposure for plantlife. Topography within the monument, typical of southwestern Arizona, is characterized by short, northerly trending mountain ranges separated by wide, nearly level valleys, or basins. Mountain slopes are rugged and precipitous, with surface rock bare or covered with only a veneer of talus. There are few seeps and springs and no permanent streams in the entire monument. Nevertheless, during hundreds of centuries, intermittent streams caused by periodic rains, particularly the sometimes torrential cloudbursts of summer, have carved the mountains, molded alluvial fans, and built the gently sloping outwash plains, or bajadas, spreading out along the mountain bases.

The Ajo and Growler ranges are part of the extensive Basin and Range physiographic province of western and southwestern United States and northern Mexico. These ranges were caused by immense block-faulting that created sharp, staggered ridges with deep valleys between. The diagrammatic drawing at left shows this original formation. Valleys between ranges are not the result of wearing away by stream-cutting but, on the contrary, they are troughs partly filled with debris eroded from the mountains and deposited by sheet erosion and ephemeral streams.

Now knee deep in the outwash of their own debris, desert mountain ranges have built sloping alluvial fans of rocks and gravel around canyon mouths. These fans join to form continuous, slightly sloping aprons, or bajadas, of finer materials that have been deposited farther out. Toward the centers of the valleys are wide, nearly level plains of clay and silt which may be hundreds of feet deep in places.

Sudden but brief storms drop a considerable volume of water on the mountains within the monument. Most of this runoff passes west and northward by means of a system of arroyos and sandy washes into the usually dry bed of the Gila River. About one-fifth of the monument area drains south into the Sonoyta River of Mexico, thence toward the Gulf of California. These well-defined drainage systems indicate that a long time

has elapsed since the occurrence of earth movements that gave rise to the present surface features.

Mountains in the monument are of two types—the mesas, with broad, nearly flat summits capped with lava; and the sierra type, with knife-edge ridges and pointed summits. Slopes of the latter are precipitous, and canyons are more open than those of the mesas. Maturely eroded ranges are generally bordered with outwash aprons, while the mesalike, lava-capped mountains are not.

Geologists tell us that at some time during the Paleozoic era (180 to 510 million years ago) this region settled beneath the sea and remained there until the beginning of Permian time. During the following 120 million years of the Mesozoic era, this area was probably land. About that time molten lavas invaded the deep buried bedrocks, cooling slowly to form granite. (For ages of the geologic formations and rock units, see table below.)

Somewhat later, a new invasion of molten materials pushed closer to the surface, forming "Tertiary granites." Cooling magmas separated into solutions that produced the mineral deposits at Ajo and elsewhere. Grayish-white rhyolite dikes and intrusions associated with this early Tertiary activity are noticeable in the Growler Pass area and include outcroppings of black, gray, and green obsidian (volcanic glass).

*Ages of formations and rock units, Organ Pipe Cactus National Monument*¹

<i>Formation or rock unit</i>	<i>Geologic age</i>	<i>Approximate age in millions of years</i>
Alluvium fill	Recent and Pleistocene	Present to 1
Younger volcanics	Pleistocene and Pliocene	1 to 10
Daniels conglomerate	Middle Tertiary	10 to 40
Older volcanics	Middle Tertiary	10 to 40
Intrusive rhyolite	Early Tertiary	40 to 60
Younger "granite," and ore deposits ascribed to its influence.	Early Tertiary	40 to 60
Older "granite" and schist . .	Middle and Late Mesozoic	125 to 180
Sedimentary series	Paleozoic	180 to 510
Cardigan gneiss	Precambrian	More than 510

¹ From Butler, B. S., and J. V. Lewis, *Mineralization in the Organ Pipe Cactus National Monument, Arizona*, 1940. Unpublished manuscript, available in open files at National Park Service, Southwest Regional Office, Santa Fe, N. Mex.

During the middle and late Tertiary period, violent volcanic activity took place in the vicinity. Surface eruptions resulted in the formation of two great series of volcanic rocks (andesitic tuffs and breccias, and lava flows), which are the dominant rocks composing the major mountain ranges of the monument today. Earth movements ending about the close of the Tertiary period (perhaps extending into the Pleistocene) brought about the great displacement of earth blocks that roughly outline the present mountain ranges, as well as the depressed areas between them.

Geological history, then, recounts that the Sonoyta Hills, the Quitobaquito Hills, and outcroppings along the southwestern foot of the Dripping Springs Range and also near Growler Pass are remnants of ancient schists, gneisses, and granites, more recently uncovered by erosion. The granites resulted from slow cooling of intrusive Precambrian or Mesozoic magmas. The schists and gneisses are ancient rocks probably of varied types which have been changed, or metamorphosed, to their present forms.

The Puerto Blanco, Growler, and Ajo Mountains are composed of thick layers of volcanic materials that were poured out during the series of great Tertiary lava flows and were later lifted by block faulting. Erosion continuing since that time has worn down these mountains, cutting canyons in their slopes and depositing the debris in the depressions between ranges, thus forming the wide, nearly level Ajo, Sonoyta, La Abra, and Growler valley plains.

A few small, widely scattered centers of mineralization developed in connection with the early molten intrusives. Silver, lead, and some gold were found along outcroppings of these very old rocks in the southern and southwestern part of the monument and along the southwest base of the Puerto Blanco Mountains. Other mineralized pockets, principally containing copper, occur in outcroppings of the old rocks near Growler Pass in the northwestern part of the monument and at Copper Hill in the northeastern part.

The only well-bedded sedimentary rocks recorded within the monument are layers of shale (probably Paleozoic), sandstone, limestone, and a bouldery limestone conglomerate which have been generally metamorphosed by heat from the volcanics into phyllite, quartzite, and marble, respectively. In the process of alteration, these rocks were rendered more resistant to weathering, and hence their outcrops form prominent ledges.

These very old sedimentary deposits occur along the extreme northern border of the monument about 1 mile north of Growler Pass and in low hills at intervals for 3 miles farther north. No fossils have been found in rocks within the monument, those once contained in them having been destroyed during the process of alteration. Some fossils do occur in the limestone boulders of the Locomotive fanglomerate outcropping in the Growler Mountains north of the monument.

Rocks of the earlier volcanic action constitute the greater part of the mountain masses. They form cliffs and precipitous slopes even where they have been covered by flows of more recent lavas. Within the monument, these volcanic rocks occupy some 90 square miles of the surface. They make up the greater part of the Ajo and Dripping Springs ranges, and also the northwestern part of the southern Growler Mountains.

These older volcanics include a wide range of eruptive materials, the most prominent of which are the andesitic tuffs and breccias and the brown and purplish-brown flow-lavas which are increasingly prominent toward the top of the series.

Younger flows of basaltic andesite and basalt cover many of the older volcanic rocks. The most extensive and youngest lava deposit within the monument is the capping that covers the greater part of the southern range of the Growler Mountains, almost 30 square miles in area. Generally, it rests on the eroded surface of earlier volcanics, and in places it overlaps other old formations. Erosion has removed this cover from earlier tuffs and lavas in a rugged, pinnacled area of 2 or 3 square miles immediately south of Bates Well.

Even the youngest volcanics have been faulted and in some places deeply eroded. They are nearly everywhere tilted somewhat, and at many places they are overlapped or buried by alluvium to depths of several hundred feet. Much of the lava forming both the older and younger flows probably rose to the surface through fissures, for no volcanic plugs or other evidences of vents of former volcanoes have been found within the monument.

Between the widely separated mountain ranges lie broad alluvial plains, or valleys. These deposits, made up of enormous quantities of material eroded from the mountains, vary in character with the types of rocks from which they were derived. In general, the texture of the alluvium changes with the distance that water has carried it from the mountains. Large

boulders are most numerous near the mouths of canyons; smaller boulders and pebbles dominate farther out; and sand, silt, and clay are found mainly in the lower and flatter central areas of the plains. The coarsest material maintains the steepest slopes, whereas the finer silts and clays have built up surfaces that are nearly level. Much of the alluvium is thought to have accumulated during Pleistocene times, but some of the deeper basin fills may date back even to the Pliocene. The process of erosion which carries debris from the mountains out into the valleys is, of course, continuing and will keep on as long as there are mountains and running water to erode them.

Climate

ORGAN PIPE CACTUS NATIONAL MONUMENT lies at the eastern edge of the driest section of the United States and in the general area of highest temperatures. Day-time temperatures from December through February are usually in the sixties—what the local people call “shirt-sleeve weather.” The air becomes warmer in March and April. From May until about October, maximum daytime temperatures usually exceed 100° F. The latter part of October and all of November are cooler. You can count on a drop of 30° between the high day and low night temperatures the year round. You need not be frightened away by those hot summer days, because, owing to the low humidity, you should find them much less unpleasant than you would similar temperatures in a humid climate. Autumn, winter, and early spring are, of course, more comfortable than summer.

Rainfall comes during December, January, and February, and in the July-September period. Winter precipitation consists of light, but steady, general rains that occasionally last for several days. Summer rains come in the form of sudden, brief, spotty, and often violent thundershowers, sometimes so torrential that they cause sheet floods and powerful, but short-lived, accumulations of runoff water rushing along desert washes.

Whether the maximum precipitation occurs in winter or summer, neither season can be depended upon to bring much moisture in any one year. One season may bring considerably more rain than the next several seasons, and in summer, parts of the area may be partially or entirely skipped while nearby locations receive a heavy downpour.

Visible evidence of this unequal distribution of moisture is presented by the condition of plant growth, particularly in the abundance and luxuriance of the spring flower display, which is acutely dependent upon winter rainfall. In Papagueria (land of the Papago Indians, of which Organ Pipe Cactus National Monument is a part), storms of freshet-making proportions may be 3 to 5 years apart, and the torrents instrumental in large-scale erosion are apparently separated by decades or even centuries. Because of the region's high temperature level, relative humidity is low, especially during the day, and evaporation of such moisture as may be present occurs at a high rate.

Winter rains create streams that may flow weakly in otherwise dry watercourses for a few days. Sudden local flash floods can cover parts of the desert with moving sheets of water and roar down arroyos for a few hours following violent cloudbursts. But there is almost no permanent surface water in all the 330,000 acres of the monument. In the mountains, there are a number of natural rock pockets, or tinajas, which collect and hold rainwater. These, together with occasional springs and seeps, provide the only natural water for deer, bighorn, and other animals that require moisture in addition to that which they obtain from their food.

Of the known dependable moisture sources, Dripping Springs, on the north side of the Puerto Blanco Mountains, and Bull Pasture Spring, about 20 miles north of the international boundary on the west slope of the Ajo Mountains, are small but important watering places for animals. Trickles from a series of warm (80° F.), mineralized outflows, totaling 43 gallons per minute at Quitobaquito Springs near the southwest corner of the monument, were united and impounded about 60 years ago with the aid of a series of low dikes. This formed a pond, which was used for primitive irrigation farming. Another water source, Rincon Spring, is about 1½ miles northwest of Quitobaquito. There is a small spring, called Aguajita, half a mile east of Quitobaquito.



Papago women make beautiful baskets from native plant material.

Man in the

ORGANPIPE COUNTRY

IN A DESERT REGION, the presence of a dependable source of water is of vital importance to many forms of life, including man. That Indians have lived in the area for the past several thousand years is attested by stone implements, pottery fragments, and the remains of ancient campsites which have been found in the monument and its vicinity.

The very early people were nomads, depending upon native plants and animals for food and the occasional springs, seeps, and tinajas for water. It is not known whether these prehistoric people were ancestors of the Papago Indians who were living in this region when the first historical records were made.

Although the Papagos developed a primitive agriculture, using floodwater irrigation, they subsisted principally by hunting and gathering native plants and seeds. Among their main foods were mesquite beans and cactus fruits. As far as is known, these desert Indians established no permanent villages within what is now Organ Pipe Cactus National Monument. Indications of occasional occupation of caves and the remains of simple shelters suggest that inhabitants of Papago villages east of the Ajo Mountains made annual pilgrimages into the area to harvest fruits of the organpipe and saguaro cactuses. Presumably this activity was continued for generations—before, as well as after, the arrival of Europeans.

Coronado and his expeditionary force in 1540 did not come within 100 miles of the present monument, but he sent his lieutenant, Melchior Diaz, to make contact with Alarcon who was at that time exploring by ship the Gulf of California and the lower reaches of the Colorado River. Although there is no positive evidence that Diaz set foot on land now within the boundaries of the monument, he must have passed nearby. His name, as that of the first European to see the area, has been memorialized in Diaz Peak, a mountain in the southeastern part of the monument.

In 1699, the energetic, mission-building Jesuit, Father Eusebio Kino, established a small mission near Sonoyta, a few miles south of the present monument boundary. Kino pioneered the route passing south of Quitobaquito along the Sonoyta River to Agua Dulce and El Carrizal, then striking boldly across the desert to the Gila River. This route, later called Camino del Diablo (Devil's Highway), was used at intervals for more than two centuries. Francisco Garcés and Pedro Font, Franciscan missionaries among the desert Indians, passed this way

during the 1770's. Juan Bautista de Anza led a party of colonists from Tubac, about 100 miles east, north of the present monument in 1776 en route to California and the founding of San Francisco.

During the period of Spanish occupation from 1539 to 1823, and of Mexican rule from 1823 to 1853, the search for precious metals led prospectors into the region. Discovery of gold in California brought a flood of travel from the East, beginning in 1849, over the various immigrant routes, including the Camino del Diablo. Some of the livestock and a few of the travelers perished as a result of the rigors of the desert and attacks by Indians and Mexican bandits.

Following the Gadsden Purchase in 1853, which established the present boundary between the United States and Mexico, prospectors came into the area and opened a number of small mines. Among those within the monument are Copper Hill, Growler, Milton, and Victoria. Although some gold, silver, and copper was found, none of the mines proved profitable, and hence they were worked only sporadically.

As far as is known, Quitobaquito Springs is the only continuously used location within the monument. Never the site of a permanent settlement, it served for many years as a major watering place for Sand Papago Indians, who occupied the region around the head of the Gulf of California. In 1830, a group of Sand Papagos who had established themselves alongside Camino del Diablo were driven off by Mexican authorities. Later, squatters at Quitobaquito impounded the spring waters for a small irrigation operation. And between 1888 and 1892 a Mexican Jew, Mikul Levi, built and operated a small store at this location.

Cattle were introduced to this region by Father Kino in 1699. After the Gadsden Purchase, grazing activities increased, with small-scale operations by several stockmen. These interests, in the Organ Pipe vicinity, were taken over by Robert Gray and his sons in the 1920's. When the area became a National Monument, the Gray family was issued a special-use permit to continue grazing during the lifetime of the father and his sons, but they were not to expand the herd of 1,050 cattle then in the monument. An Executive order of November 12, 1923, set aside Quitobaquito Springs and an adjacent tract of approximately 40 acres as a public watering place, reserving it from settlement.



Following a reconnaissance in 1932, the Tucson Natural History Association began pressing for the preservation of an outstanding area of typical Sonoran Desert which would include stands of organpipe cactus. In 1934 the Pima County Board of Supervisors and the Ajo Chamber of Commerce went on record favoring the proposal, and in 1935 the National Park Service sent a group of officials into the desert south of the town of Ajo to carry out a detailed survey. This group recommended, for National Monument status, approximately the area included within the present boundaries. This recommendation was approved by the Secretary of the Interior on December 28, 1935, and the Presidential proclamation creating Organ Pipe Cactus National Monument was signed on April 13, 1937.

Funds for the protection and development of the monument were made available in 1939, and the first custodian, William R. Supernaugh, was appointed in October of that year. He established his residence and office in Ajo. With a dependable supply of potable water as the prime consideration, a geological reconnaissance was made, a headquarters site was selected, and a well was drilled. In September 1944, the custodian moved onto the monument.

Publicity connected with the establishment and opening of the monument stimulated a phenomenal rise in the tempo of travel to the area (9,963 visitors in 1940 and 329,800 in 1963), making necessary the establishment of an adequate campground and the development of an access road system to enable visitors to reach and enjoy the areas of principal interest.

Under the National Park Service's MISSION 66 program, plans for the monument headquarters development were pushed, and in 1958 a visitor center building was completed and opened for public use.

(Above) This typical Papago home is on the reservation immediately east of the monument. (Below) Mesquite fruits provide food for wildlife and at one time were a staple item in the diet of Papago Indians and pioneers.

Suggestions for Further Reading

IT IS HOPED that this handbook will stimulate your interest and help you to understand and appreciate Organ Pipe Cactus National Monument. Because of limited space, only the major attractions of the monument have been outlined. The following publications, some of which are available for purchase at the information desk in the visitor center, will answer many of your remaining questions and give you a deeper insight into the fascinating methods by which plants and animals of the desert, and of the desert mountains, meet the stern requirements of a hot and arid climate.

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Glossary

<i>Term</i>	<i>Origin</i>	<i>Pronunciation</i>	<i>Meaning or usage</i>
Agave	Spanish	ah-GAH-vay	Centuryplant.
Ajo	Spanish	AH-hoh	Garlic.
Agua Dulce	Spanish	AH-wah	Sweet water.
		DOOL-say	
Aguajita	Spanish	AH-wah	Emitting water.
		HE-tah	
Arroyo	Spanish	ah-ROY-oh	A gully.
Bajada	Spanish	bah-HAH-dah	Sloping plain.
Bisnaga	Indian	bees-NAH-gah	A barrelcactus.
Cabeza Prieta	Spanish	kah-BAY-sah	Black head.
		pree-ET-ah	
Cereus	Latin	SEE-re-us	Cactus genus.
Cholla	Spanish	CHO-yah	Bush-type cactus.
Datil	Spanish	DAT-ill	Date; fruit like a date.
Echinocereus	Latin	e-KINE-oh-	A cactus group,
		SEE-re-us	or genus.

<i>Term</i>	<i>Origin</i>	<i>Pronunciation</i>	<i>Meaning or usage</i>
Galleta	Spanish	gah-YET-ah	Desert clump grass.
Gila	Indian	HEE-lah	River in southern Arizona.
Gneiss	Probably Latin	nice or NAY-is	Crystalline rock.
Iguana	Spanish	e-goo-AH-nah	A lizard.
Jojoba	Probably Indian	hoh-HOH-bah	An evergreen shrub.
Kino	Spanish	KEE-noh	A Spanish proper name.
La Abra	Spanish	lah AH-brah	A dale, or valley.
Mesa	Spanish	MAY-sah	A table; a flat-topped mountain.
Mesquite	Spanish form of an Indian word.	mess-KEET	A desert tree.
Ocotillo	Spanish	oh-koh-TEE-yoh	A desert shrub.
Paloverde (the plant) .	Spanish	PAHL-oh-VEHR-dey	Green stick.
Papago	Spanish form of a native name.	PAHP-ah-go	Desert Indian tribe.
Papagueria	Spanish	PAHP-ah-geh-REE-ah	Land of Papago Indians.
Phainopepla	Latin	fane-oh-PEP-lah	One of the silky fly-catchers.
Pima	Spanish form of a native name.	PEE-mah	A desert Indian tribe.
Pitahaya dulce . . .	Spanish	pee-TAH-yah DOOL-say	Sweet fruit of a cactus.
Puerto Blanco . . .	Spanish	poo-EHR-toh BLAHN-coh	White pass.
Quitobaquito	Indian	KEE-toh-bah-KEE-toh	Spring and pond in southwest corner of monument.
Reina-de-la-noche	Spanish	ray-E-nah de la NO-chay	Queen-of-the-night.
Rincon	Spanish	reen-CONE	An inside corner.
Saguaro	Spanish form of an Indian word.	sah-WAH-roe	Giant cactus.
Sangre de drago . .	Spanish	SAHN-gray de DRAH-go	Blood of the dragon.
Sapium	Latin	SAY-pee-um	A plant genus.
Senita	Spanish	sen-EE-tah	The old one.
Sierra	Spanish	see-EHR-rah	Saw-toothed-ridge mountain range.
Tinaja	Spanish	tee-NAH-hah	Water jar; a pothole.
Tomatillo	Spanish	toh-mah-TEE-yoh	A little tomato.
Tuna	Spanish	TOO-nah	Cactus fruit; Indian fig.
Yucca	Spanish	YUH-kuh or YOU-kuh	Stiff-leaved plant; soapweed.

*Common and
Scientific Names*

OF PLANTS AND ANIMALS

This list of common names and their scientific (Latin) equivalents includes only those plants and animals that are mentioned in the text. With a few exceptions (those marked K. & P.), the authority for the scientific names of all plants, and for the common names of all plants except trees, is the second edition (1942) of *Standardized Plant Names*, edited by Harlan P. Kelsey and William A. Dayton. "K. & P." refers to the authors of the second edition with supplement (1960) of *Arizona Flora* by Thomas H. Kearney and Robert H. Peebles. Authority for the common names of trees is *Check List of Native and Naturalized Trees of the United States (Including Alaska)*, by Elbert L. Little, Jr. (U.S. Department of Agriculture Handbook No. 41, published in 1953). Scientific and common names of birds are based on the American Ornithologists' Union *Check-List of North American Birds*, Fifth Edition, 1957; and for amphibians and reptiles, on the sixth edition, 1953, of *A Check List of North American Amphibians and Reptiles* by Karl P. Schmidt. Authority for scientific names of mammals is *List of Recent North American Mammals*, published in 1955 as Bulletin 205 of the U.S. National Museum, whereas the common names of mammals are based on *The Mammal Guide*, 1954, by Ralph S. Palmer, or on *A Field Guide to Mammals*, 1952, by William Henry Burt and Richard Philip Grossenheider.

Whenever there is a conflict in spelling between any of the above-listed authorities and the *U.S. Government Printing Office Style Manual*, the style manual takes precedence.

PLANTS

- | | |
|--|---|
| Agave— <i>Agave schottii</i> . (K. & P.) | Brittlebush—See White brittlebush. |
| Ajo oak— <i>Quercus ajoensis</i> . | Broom baccharis— <i>Baccharis sarothroides</i> . |
| Alfilaria— <i>Erodium cicutarium</i> . | Bulb cloakfern— <i>Notholaena sinuata</i> . |
| Amaranth— <i>Amaranthus palmerii</i> . (K. & P.) | Bur-sage—See Triangle bur-sage and White bur-sage. |
| Arizona jumping cholla— <i>Opuntia bigelovii</i> . | Bursera— <i>Bursera microphylla</i> . |
| Arizona-rosewood—See Torrey vaquelinia. | California barrelcactus— <i>Ferocactus acanthodes</i> . |
| Arrowweed pluchea— <i>Pluchea sericea</i> . | California beloperone— <i>Beloperone californica</i> . |
| Barrelcactus—See Southwest barrelcactus and California barrelcactus. | California jojoba— <i>Simmondsia chinensis</i> . |
| Beloperone—See California beloperone. | Caltrop— <i>Kallstroemia grandiflora</i> . (K. & P.) |
| Big galleta— <i>Hilaria rigida</i> . | Carelessweed—See Amaranth. |
| Big saltbush— <i>Atriplex lentiformis</i> . | Catclaw acacia— <i>Acacia greggii</i> . |
| Bisnaga— <i>Echinocactus visnaga</i> . | Cattail— <i>Typha domingensis</i> . (K. & P.) |
| Blue paloverde— <i>Cercidium floridum</i> . | |

- Cattle saltbush—*Atriplex polycarpa*.
 Centuryplant—See Agave.
 Chinchweed—See Pectis.
 Christmas cholla—See Tesajo.
 Chuperosa—See California beloperone.
 Cliffbrake—*Pellaea longimucronata*.
 (K. & P.)
 Cloakfern—See Bulb cloakfern.
 Copperleaf—*Acalypha pringlei*.
 (K. & P.)
 Coville creosotebush—*Larrea tridentata*.
 Creosotebush—See Coville creosotebush.
 Crimson monkeyflower—*Mimulus cardinalis*.
 Crucifixion-thorn—See Holacantha.
 Datil yucca—*Yucca baccata*.
 Deerhorncactus—*Peniocereus greggii*.
 Desert bailey—*Baileya multiradiata*.
 Desert broom—See Broom baccharis.
 Desert-chicory—*Rafinesquia neomexicana*. (K. & P.)
 Desert globemallow—See Globemallow.
 Desertgold—*Geraea canescens*.
 Desert-honeysuckle—See California beloperone.
 Desert Indian-wheat—*Plantago fastigiata*.
 Desert-ironwood—See Tesota.
 Deserlily—*Hesperocallis undulata*.
 Desert-marigold—See Desert bailey.
 Desert-olive forestiera—*Forestiera phyllireoides*.
 Desert sandverbena—*Abronia villosa*.
 Desert-sunflower—See Desertgold.
 Desert tobacco—*Nicotiana trigonophylla*.
 Elephanttree—See Bursera.
 Engelmann echinocereus—*Echinocereus engelmannii*.
 Engelmann pricklypear—*Opuntia engelmannii*.
 Escobita owllover—*Orthocarpus purpurascens*.
 Evening-primrose—*Oenothera* sp.
 Fairy duster—See Falsemesquite calliandra.
 Falsemesquite calliandra—*Calliandra eriophylla*.
 Filaree—See Alfilaria.
 Flat-sedge—*Cyperus laevigatus*.
 Foothill paloverde—See Yellow paloverde.
 Fremont cottonwood—*Populus fremontii*.
 Globemallow—*Sphaeralcea* sp.
 Goldfern—*Pityrogramma triangularis*.
 Grama—*Bouteloua* sp.
 Gray oak—*Quercus grisea*.
 Greasewood—See Coville creosotebush.
 Gum bumelia—*Bumelia lanuginosa*.
 Hedgehog cactus—See Engelmann echinocereus.
 Holacantha—*Holacantha emoryi*.
 Holycross cholla—*Opuntia ramosissima*.
 Honey mesquite—*Prosopis juliflora* var. *glandulosa*.
 Inland saltgrass—*Distichlis stricta*.
 Iodinebush—See Pickleweed.
 Ironwood—See Tesota.
 Jointfir—See Nevada ephedra and Longleaf ephedra.
 Jumping-bean sapium—*Sapium biloculare*.
 Lipfern—*Cheilanthes lindheimeri*.
 Littleleaf paloverde—See Yellow paloverde.
 Littleleaf penstemon—*Penstemon microphyllus*.
 Longleaf ephedra—*Ephedra trifurca*.
 Lupine—*Lupinus sparsiflorus* and *Lupinus concinnus*.
 Marigold—See Desert bailey.
 Mescat acacia—*Acacia constricta*.
 Mesquite—See Honey mesquite.
 Mesquite American-mistletoe—*Phoradendron californicum*.
 Mexican bluewood—See Mexican condalia.
 Mexican condalia—*Condalia mexicana*.
 Mexican goldpoppy—*Eschscholtzia mexicana*.
 Mexican nettlespurge—*Jatropha cinerea*. (K. & P.)
 Mexican tea—See Longleaf ephedra.
 Mistletoe—See Mesquite American-mistletoe.
 Nama—*Nama demissum*. (K. & P.)
 Nettlespurge—*Jatropha cardiophylla*.
 (K. & P.)

- Nevada ephedra—*Ephedra nevadensis*.
 Oakwoods gooseberry—*Ribes quercetorum*.
 Ocotillo—*Fouquieria splendens*.
 Olney bulrush—*Scirpus olneyi*.
 One-seed juniper—*Juniperus monosperma*.
 Organpipe cactus—*Lemaireocereus thurberi*.
 Paloverde—See Blue paloverde and Yellow paloverde.
 Pectis—*Pectis papposa*. (K. & P.)
 Pencil cholla—*Opuntia arbuscula*. (K. & P.)
 Phacelia—*Phacelia crenulata*. (K. & P.)
 Pickleweed—*Allenrolfea occidentalis*.
 Purple roll-leaf—See Nama.
 Quailplant—See Salt heliotrope.
 Queen-of-the-night—See Deerhorn-cactus.
 Rattail cholla—See Holycross cholla.
 Redberry buckthorn—*Rhamnus crocea*.
 Rosinbrush—See Broom baccharis.
 Saguaro—*Cereus giganteus*.
 Saltbush—See Cattle saltbush.
 Salt heliotrope—*Heliotropium curassavicum*.
 Sangre-de-drago—See Nettlepurge.
 Sapium—See Jumping-bean sapium.
 Sapote—See Gum bumelia.
 Scarlet spiderling—*Boerhaavia coccinea*.
 Seepwillow baccharis—*Baccharis glutinosa*.
 Senita—*Lophocereus schottii*. (K. & P.)
 Shrub live oak—*Quercus turbinella*.
 Silver cholla—See Arizona jumping cholla.
 Sinita—See Senita.
 Skunkbush sumac—*Rhus trilobata*.
 Sonora jumping cholla—*Opuntia fulgida*.
 Smokethorn—*Dalea spinosa*.
 Southwest barrelcactus—*Ferocactus wislizenii*.
 Spiderling—*Boerhaavia* sp.
 Spiny hackberry—*Celtis pallida*.
 Spurge—*Euphorbia* sp.
 Summer-poppy—See Caltrop.
 Sundrops—See Evening-primrose.
 Tackstem—*Calycoseris wrightii*. (K. & P.)
 Teddybear cholla—See Arizona jumping cholla.
 Tesajo—*Opuntia leptocaulis*.
 Tesota—*Olneya tesota*.
 Texas mulberry—*Morus microphylla*.
 Torrey vauquelinia—*Vauquelinia californica*.
 Tree tobacco—*Nicotiana glauca*.
 Triangle bur-sage—*Franseria deltoidea*.
 Utah juniper—*Juniperus osteosperma*.
 Velvet mesquite—*Prosopis juliflora* var. *velutina*.
 White brittlebush—*Encelia farinosa*.
 White burrobrush—*Hymenoclea salsola*.
 White bur-sage—*Franseria dumosa*.
 Wild-heliotrope—See Phacelia.
 Wolfberry—*Lycium fremontii*.
 Yellow beardtongue—See Littleleaf penstemon.
 Yellow-flowered gooseberry—See Oakwoods gooseberry.
 Yellow paloverde—*Cercidium microphyllum*.
 Yerba-de-fleche—See Jumping-bean sapium.

MAMMALS

- Antelope—See Pronghorn.
 Badger—*Taxidea taxus*.
 Bighorn—*Ovis canadensis*.
 Black-tailed jackrabbit—*Lepus californicus*.
 Bobcat—*Lynx rufus*.
 Coues deer—See White-tailed deer.
 Coyote—*Canis latrans*.
 Desert cottontail—*Sylvilagus auduboni*.
 Desert woodrat—*Neotoma lepida*.
 Gray fox—*Urocyon cinereoargenteus*.
 Javelina—See Peccary.
 Kangaroo rat—*Dipodomys merriami* and other species.
 Kit fox—*Vulpes velox*.
 Long-nosed bat—*Leptonycteris nivalis*.
 Mountain sheep—See Bighorn.
 Mule deer—*Odocoileus hemionus*.
 Peccary—*Pecari angulatus*.
 Pronghorn—*Antilocapra americana*.

Ringtail—*Bassariscus astutus*.
 Round-tailed ground squirrel—*Citellus tereticaudus*.
 Skunk
 Hog-nosed—*Conepatus leuconotus*.
 Hooded—*Mephitis macroura*.

Spotted—*Spilogale putorius*.
 Striped—*Mephitis mephitis*.
 White-tailed deer—*Odocoileus virginianus couesi*.
 White-throated woodrat—*Neotoma albigula*.

BIRDS

American coot—*Fulica americana*.
 American widgeon—*Mareca americana*.
 Baldpate—See American widgeon.
 Belted kingfisher—*Megasceryle alcyon*.
 Bendire's thrasher—*Toxostoma bendirei*.
 Black-throated sparrow—*Amphispiza bilineata deserticola*.
 Black phoebe—*Sayornis nigricans*.
 Black-tailed gnatcatcher—*Polioptila melanura lucida*.
 Black vulture—*Coragyps atratus*.
 Brewer's sparrow—*Spizella breweri breweri*.
 Cactus wren—*Campylorhynchus brunneicapillum couesi*.
 Brown-headed cowbird—*Molothrus ater*.
 Brown towhee—*Pipilo fuscus*.
 Canyon wren—*Catherpes mexicanus conspersus*.
 Cardinal—*Richmondia cardinalis superba*.
 Chipping sparrow—*Spizella passerina arizonae*.
 Cooper's hawk—*Accipiter cooperii*.
 Coot—See American coot.
 Crissal thrasher—*Toxostoma dorsale*.
 Curve-billed thrasher—*Toxostoma curvirostre palmeri*.
 Desert sparrow hawk—See Sparrow hawk.
 Elf owl—*Micrathene whitneyi*.
 Ferruginous owl—*Glauclidium brasilianum cactorum*.
 Gambel's quail—*Lophortyx gambelii gambelii*.
 Gila woodpecker—*Centurus uropygialis*.
 Gilded flicker—*Colaptes chrysoides mearnsi*.

Gnatcatcher—See Black-tailed gnatcatcher.
 Golden eagle—*Aquila chrysaetos*.
 Great horned owl—*Bubo virginianus pallescens*.
 Grebe—See Pied-billed grebe.
 Heron—*Ardea* sp. and *Nycticorax* sp.
 Horned owl—See Great horned owl.
 House finch—*Carpodacus mexicanus frontalis*.
 Killdeer—*Charadrius vociferus*.
 Kingfisher—See Belted kingfisher.
 Lark bunting—*Calamospiza melanocorys*.
 Lesser scaup—*Aythya affinis*.
 Linnet—See House finch.
 Mallard—*Anas platyrhynchos*.
 Mockingbird—*Mimus polyglottos leucophterus*.
 Mourning dove—*Zenaidura macroura marginella*.
 Phainopepla—*Phainopepla nitens lepida*.
 Pied-billed grebe—*Podilymbus podiceps podiceps*.
 Pyrrhuloxia—*Pyrrhuloxia sinuata fulvescens*.
 Redhead duck—*Aythya americana*.
 Red-tailed hawk—*Buteo jamaicensis calurus*.
 Roadrunner—*Geococcyx californianus*.
 Rock wren—*Salpinctes obsoletus*.
 Sage thrasher—*Oreoscoptes montanus*.
 Sandpipers—*Tringa solitaria* and other species.
 Snipe—*Capella gallinago*.
 Sparrow hawk—*Falco sparverius*.
 Swainson's hawk—*Buteo swainsoni*.
 Swallows—*Petrochelidon* sp., *Stelgidopteryx* sp.

- Teal—*Anas* sp.
 Turkey vulture—*Cathartes aura teter*.
 Verdin—*Auriparus flaviceps acaciarius*.
 Vermilion flycatcher—*Pyrocephalus rubinus flammeus*.
 Vireo—*Vireo* sp.
- Warblers—*Dendroica* sp.
 White-crowned sparrow—*Zonotrichia leucophrys*.
 White-winged dove—*Zenaida asiatica mearnsi*.
 Wood ibis—*Mycteria americana*.

AMPHIBIANS AND REPTILES

- Arizona zebra-tailed lizard—*Callisaurus draconoides ventralis*.
 Checkered whiptail—*Cnemidophorus tessellatus*.
 Chuckwalla—*Sauromalus obesus*.
 Couch's spadefoot—*Scaphiopus couchi*.
 Crested lizard—See Desert iguana.
 Desert iguana—*Dipsosaurus dorsalis dorsalis*.
 Gila monster—*Heloderma suspectum*.
 Mojave rattlesnake—*Crotalus scutulatus*.
 Racetracker—See Checkered whiptail.
- Rattlesnake
 See Mojave rattlesnake.
 See Sidewinder.
 See Western diamondback rattlesnake.
 Red-spotted toad—*Bufo punctatus*.
 Sidewinder—*Crotalus cerastes*.
 Sonora spiny lizard—*Sceloporus clarki clarki*.
 Spiny lizard—See Sonora spiny lizard.
 Western diamondback rattlesnake—*Crotalus atrox*.
 Western red racer—*Masticophis flagellum frenatus*.

INSECTS

- Cone-nose—*Triatoma rubida*.
 Honey bee—*Apis mellifica*.
- Termites—*Kaloterms*, *Amiterms*, and *Reticuliterms* sp.
 White ant—See Termites.

FISH

- Desert pupfish—*Cyprinodon macularius*.

ARACHNID

- Desert hairy scorpion—*Hadrurus hirsutus*.

